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ABSTRACT

This is one of eighteen sets of individualized mathematics problems developed by the Oregon Vo-Tech Math Project. Each of these problem packages is organized around a mathematical topic and contains problems related to diverse vocations. Solutions are provided for all problems. Problems in this set require computations involving whole numbers. Problems are drawn from nineteen vocational areas: clerical work; aviation mechanics, diesel mechanics, wood products, wastewater technology, forestry, fire and police science, agriculture, forest products, nursing, industrial, electrical and hydraulics technology, marketing, drafting, machine tools, industrial mechanics, auto mecahnics, construction, real estate, and food processing. (SD)

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I
L INDIVIDUALIZED
S LEARNING
SYSTEMS

Individualized Math Problems in

Whole Numbers

Oregon Vo-Tech Mathematics Problem Sets

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O
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Salem, Oregon 97310
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Individualized Learning Systems

MATHEMATICS

Whole Numbers

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WHOLE NUMBERS
Level 1

Retrieval ... Center
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Clerical

A. Problems with Solutions

1. Statistics show that our town has 20,258 persons under 25 years old; 16,977 between 25 and 65 years of age; and 8,968 over 65 years old. How many people live in our town?

   Solution:

   20,258 people
   16,977 people
   8,968 people
   46,203 people

2. If there are 759 families in the suburb of Linnville and the median family income is $12,750 a year, what should be a good estimate of the annual income of the community?

   Solution:

   (759 families)($12,750/family) = $9,677,250

3. Burns Bakery uses 59 lbs of rye flour a week. They have 354 lbs on hand. How many weeks will it last?

   Solution:

   $\frac{354 \text{ lbs}}{59 \text{ lbs/week}} = 6 \text{ weeks}$

4. Weekly Production, Part X

Name	Average Hourly Prod.	Hours Scheduled	Output Expected
Adams	173	40	
Bolton	142	32	
Carlson	161	37	
Davis	163	28	

Compute Output Expected Total _____

Solution:

First multiply average hourly production by hours scheduled. Then add the products.

Adams	(173 output/hr)	(40 hrs)	=	6,920 output
Bolton	(142 output/hr)	(32 hrs)	=	4,544 output
Carlson	(161 output/hr)	(37 hrs)	=	5,957 output
Davis	(163 output/hr)	(28 hrs)	=	4,564 output
				21,985 output

A. Problems with Solutions (continued)

5. A ticket seller at a baseball game was given 150 eighty-five cent tickets and $25 in change. At the end of the game he turned in 17 tickets and $138.25 in money.

(a) Is this the amount of money he should have returned?

(b) If not, how much was it more or less than the correct amount?

Solution:

(a) First find out how many tickets he sold:
150 tickets - 17 tickets = 133 tickets
At 85¢ per ticket: (133 tickets)($0.85/ticket) = $113.05
He should turn this in plus the $25: $113.05 + $25 = 138.05
The answer to (a) is No.

(b) The difference between $138.25 - $138.05 = $0.20
He should have turned in 20¢ less.

B. Problems without Solutions

6. Man-Hours Lost From Industrial Accidents, 1973

Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
185	96	128	89	195	116	129	160	98	114	136	145

(a) Compute the total 1973 man-hours lost.

(b) What is the average monthly man-hours lost?

Solution:

B. Problems without Solutions (continued)

7. The New York Stock Exchange listed the following stocks as the ten leaders in volume of sales for a particular day:

Imperial Cp of Amer	425,700
Bristol Myers	233,700
Sinclair	199,400
Occidental Petrol	136,300
Eastern Airlines	128,700
Gulf and Western	125,600
Chrysler	124,400
Gerber Products	124,400
American Motors	120,500
Swift Co.	109,100

(a) What was the total number of shares sold for the top ten companies that day?

(b) By how many shares did the volume of Chrysler stock exceed the sales of American Motors stock?

(c) What was the total number of shares sold of Sinclair, Occidental Petrol, and Gulf and Western?

Solution:

B. Problems without Solutions (continued)

8. The following quotations were given for two days for the New York Stock Exchange.

	Friday	Thursday
Volume of shares traded	14,150,000	18,300,000
Different companies whose stock was traded (Issues Traded)	1,582	1,612
Issues that advanced in price	741	584
Issues that declined in price	604	832

(a) How much less was the volume for Friday than it had been on Thursday?

(b) What was the difference in issues traded for the two days?

(c) How many more stocks showed advances on Friday than on Thursday?

(d) By how much did those stocks showing advances outnumber those showing declines on Friday?

Solution:

9. At the beginning of the week Smith's Grocery had 14 brooms in stock. During the week a shipment of 3 dozen arrived and all of them were put in stock. At the end of the week 23 remained in stock. How many were sold during the week?

Solution:

B. Problems without Solutions (continued)

10. Max Corporation assembles a special type machine. Calculate the total time necessary to complete the assembly of the product.

Process A - 2 hrs 22 min

Process B - 7 hrs 56 min

Process C - 4 hrs 47 min

Process D - 6 hrs 8 min

Solution:

11. Deliveries of milk to the Green Haven Cheese Factory from 5 local dairies were as follows: 2,470 gallons, 3,240 gallons, 2,210 gallons, 1,570 gallons, and 3,765 gallons. How many gallons were delivered to the factory.

Solution:

12. A canning factory received an order for 18,048 cans of peas. If four dozen cans are packed in a box, how many boxes are needed for this order?

Solution:

B. Problems without Solutions (continued)

13. The total circulation for a newspaper for 42 days was 120,792. What was the average daily circulation?

Solution:

14. A fire insurance policy was taken out for three years dated June 1, 1965, and premium paid for three years was $36. The property was sold January 1, 1967. How much would you prorate to the buyer?

Solution:

15. On the morning of June 7, E. N. Perry, a florist, placed $30 in change in his cash register. At the close of the day the register totals showed he had taken in $341.13 and had paid out $7.65. Upon counting the money in the cash drawer, he found that he had $363.77. How much was the cash over or short?

Solution:

B. Problems without Solutions (continued)

16. A ticket seller at a football game was given 225 seventy-five cent tickets and $20 in change. At the end of the game, he turned in 32 tickets and $163.75 in money.

(a) Is this the correct amount of money he should have returned?

(b) If not, how much was it more or less than the correct amount?

Solution:

17. What is the average daily payroll per employee for the Ace Box Co. if the total daily payroll for 25 employees equaled the following amounts: $674, $650, $700, $630, and $625?

Solution:

18. Visitors to the county museum during the first week after it had opened were as follows: Sunday, 869; Monday, 456; Tuesday, 317; Wednesday, 725; Thursday, 294; Friday, 375; and Saturday, 961. What was the average daily attendance?

Solution:

B. Problems without Solutions (continued)

19. Yesterday, a cashier started the day with $82.50 in change. At the end of the day the cash register totals showed that $639.27 had been taken in and $3.42 paid out. There was $718.18 in the cash drawer. By how much was the cash over or short?

Solution:

20. A real estate agent sold a 37-acre farm at $42 per acre. He took as part payment a smaller farm of 16 acres at $50 per acre. How much cash should he receive in addition?

Solution:

Complete Solutions to B Problems

6. (a)
185 hrs
96 hrs
128 hrs
89 hrs
195 hrs
116 hrs
129 hrs
160 hrs
98 hrs
114 hrs
136 hrs
145 hrs
1,591 hrs

(b) Divide the total by the number of months.

$\frac{1,591 \text{ hrs}}{12 \text{ months}} = 132.583 \text{ hrs/month}$

7. (a)
425,700 shares
233,700 shares
199,400 shares
136,300 shares
128,700 shares
125,600 shares
124,400 shares
124,400 shares
120,500 shares
+ 109,100 shares
1,727,800 shares

(b)
124,400 shares
- 120,500 shares
3,900 shares

(c)
199,400 shares
136,300 shares
+ 125,600 shares
461,300 shares

8. (a)
18,300,000 shares
- 14,150,000 shares
4,150,000 shares

(b)
1,612 issues
- 1,582 issues
30 issues

(c)
741 stocks
- 584 stocks
157 stocks

(d)
741 stocks
- 604 stocks
137 stocks

9. There are 12 in a dozen. Multiply 3 X 12 and add 14. This tells how many he had to sell all together. Then subtract 23.

(3 dozen)(12 brooms/dozen) = 36 brooms
+ 14 brooms
50 brooms
- 23 brooms
27 brooms

Complete Solutions to B Problems (continued)

10. Add all the times together and simplify.

$$\begin{array}{r} 2 \text{ hrs} \quad 22 \text{ min} \\ 7 \text{ hrs} \quad 56 \text{ min} \\ 4 \text{ hrs} \quad 47 \text{ min} \\ +\ 6 \text{ hrs} \quad 8 \text{ min} \\ \hline 19 \text{ hrs} \quad 133 \text{ min} \end{array} = 21 \text{ hrs } 13 \text{ min}$$

11.
$$\begin{array}{r} 2{,}470 \text{ gallons} \\ 3{,}240 \text{ gallons} \\ 2{,}210 \text{ gallons} \\ 1{,}570 \text{ gallons} \\ +\ 3{,}765 \text{ gallons} \\ \hline 13{,}255 \text{ gallons are delivered} \end{array}$$

12. Cans per box = (4 dozen/box)(12 cans/dozen) = 48 cans/box
X = number of boxes needed

$$X = \frac{18{,}048 \text{ cans}}{48 \text{ cans/box}} = 376 \text{ boxes}$$

13. D = average daily circulation

$$D = \frac{120{,}792 \text{ newspapers}}{42 \text{ days}} = 2{,}876 \text{ papers per day}$$

14. Policy taken out for 3 years on June 1, 1965
Maturity date: June 1, 1968
All of 1967 should be prorated to the buyer because the property changed hands on the first of the year. January thru May of 1968 should also be prorated. 17 months should be prorated.

(12 months/year)(3 years) = 36 months

$$\left(\frac{\$36}{36 \text{ months}}\right)(17 \text{ months}) = \$17 \text{ amount to be prorated}$$

15.
$$\begin{array}{r} \$30.00 \\ +\ 341.13 \\ \hline 371.13 \\ -\ 7.65 \\ \hline \$363.48 \end{array}$$ should have been in register

$$\begin{array}{r} \$363.77 \\ -\ 363.48 \\ \hline \$ \quad .29 \end{array}$$ Mr. Perry was $0.29 over

Complete Solutions to B Problems (continued)

16. (a) Tickets sold = 225 tickets - 32 tickets
= 193 tickets
He should have turned in:
(193 tickets)($0.75/ticket) + $20 = $164.75
He did not turn in the correct amount.

(b) $164.75 - $163.75 = $1.00
He should have turned in $1.00 more.

17.
$674
650
700
630
+ 625
$3,279 weekly payroll

$\frac{\$3,279/\text{week}}{5\ \text{days/week}} = \$655.80/\text{day}$

$\frac{\$655.80/\text{day}}{25\ \text{employees}} = \$26.23$ daily pay per employee

18.
869
456
317
725
294
375
+ 961
3,997 weekly attendance

$\frac{3,997\ \text{people/week}}{7\ \text{days/week}} = 571$ people per day

19.
$82.50
+ 639.27
$721.77
- 3.42
$718.35 should have been in register

$718.35
- 718.18
$ .17 Cashier was $0.17 short.

20. (37 acres)($42/acre) = $1,554
(16 acres)($50/acre) = $800

$1,554
- 800
$ 754 Therefore, the agent should receive an additional $754

A. Problems with Solutions

1. If the shear strength of a 1/8 in 2117-T3(AD) rivet is 344 lbs, and it is necessary to provide a tensile strength of 5600 lb to a joint, how many rivets would be required?

Solution:

When shear strength and tensile strength are known, it is possible to determine the number of rivets required in a repair by dividing the shear strength of one rivet into the required tensile strength of the joint.

$\frac{5600}{344} \approx 16.03$ Use 17 rivets

B. Problems without Solutions

2. If the liquid pressure on a surface is 8 psi, what is the total force if the surface area is 150 sq in?

3. If all the heat energy in 1 lb of gasoline could be used, how much work (in foot-lbs) could be done? (1 lb gas = 20,000 BTU's; 1 BTU = 778 ft-lb of work.)

Complete Solutions to B Problems

2. (8 lb/~~sq in~~)(150 ~~sq in~~) = 1,200 lb

3. (778 ft-lb)(20,000) = 15,560,000 ft-lb

WHOLE NUMBERS
Level 1

Diesel Mechanic

A. Problems with Solutions

1. At midnight the revolution counter shows 376,510. At 4 a.m., it reads 397,630. What is the average number of revolutions made per minute?

Solution:

Number of revolutions is: 397,630 - 376,510 = 21,120 revs

Number of minutes is (4 hrs)(60 min/hr) = 240 min

Then, RPM = $\frac{21,120 \text{ revs}}{240 \text{ min}}$ = 88 rpm

B. Problems without Solution

2. A fuel pump delivers 9 cc of fuel per stroke. How many cc will it pump in 350 strokes?

3. What should the current flow be in a line to a 4-ohm resistance with 12 volts DC applied? (Use formula $I = \frac{E}{R}$.)

Complete Solutions to B Problems

2. (9 cc/stroke)(350 strokes) = 3,150 cc

3. $I = \frac{E}{R} = \frac{12 \text{ volts}}{4 \text{ ohms}} = 3 \text{ amps}$

A. Problems with solutions.

1. The surface measure of a 48" x 96" hardboard panel is 32 square feet. Find the surface measure of a 50" x 88" hardboard panel. Round off to the nearest square foot.

$$\text{Surface measure} = \frac{(\text{inches of length}) \times (\text{inches of width})}{144}$$

Definitions: Hardboard -- wood chips fibers combined with chemicals and pressed into a solid panel.

Surface measure -- square feet of panel surface determined by multiplication of length and width.

Solution : $\text{Surface measure} = \frac{(\text{inches of length})(\text{Inches of width})}{144}$

$$= \frac{(50")\ (88")}{144\ \frac{\text{sq in}}{\text{sq ft}}}$$

$$= \frac{4400\ \cancel{\text{sq in}}}{144\ \frac{\cancel{\text{sq in}}}{\text{sq ft}}}$$

$$= 30.555 \text{ sq ft}$$

$$\doteq 31 \text{ sq ft}$$

2. A sawmill has received an order for 2,450 board feet of 3" x 14" timbers. Each timber must be 12 or 16 feet long. The green chain grader is told to report when the ordered amount of timbers is obtained so the sawyer can stop cutting this type of lumber. The grader makes a tally of the 12 and 16 foot pieces as they are cut and determines the board footage actually cut.

a) The grader's tally shows that 37 12-foot pieces, and 15 16-foot pieces have been cut. How many more pieces are needed to fill the order?

Formula: $\text{Board measure} = \frac{\left\{\begin{matrix}\text{width in} \\ \text{inches}\end{matrix}\right\} \times \left\{\begin{matrix}\text{thickness} \\ \text{in inches}\end{matrix}\right\}}{12} \times \left\{\begin{matrix}\text{lineal} \\ \text{measure}\end{matrix}\right\}$

Definitions : Lineal measure -- length, in feet, of the timber
Grader -- worker who judges quality of lumber being cut
Sawyer -- worker who cuts logs into slabs of a certain thickness.
Tally --- a continuous record of the counted pieces of lumber
Board measure -- a unit of lumber measurement one foot long, one foot wide, and one inch thick.

A. Problems with solutions.

2. continued.

Solution: Board footage for a 12-foot piece

$$= \left(\frac{3" \times 14"}{12"}\right) \times 12'$$

$$= 3.5" \times 12' = 42 \text{ board ft.}$$

Board footage for a 16 ft piece

$$= \left(\frac{3" \times 14"}{12"}\right) \times 16'$$

$$= 3.5" \times 16' = 56 \text{ board feet}$$

Total 12-ft board footage = (37 boards) $\left(42 \frac{\text{bd. ft}}{\text{board}}\right)$ = 1554 bd. ft.

Total 16-ft board footage = (15 boards) $\left(56 \frac{\text{bd. ft}}{\text{board}}\right)$ = 840 bd ft.

+ Total	BOARD FOOTAGE	2,394 bd. ft.

The amount of shortage = 2450 bd ft - 2394 bd ft = 56 bd ft.
So, he needs to turn out 1 more 16' board.

B. Problems without solutions.

3. The mill office has a lumber order calling for 10,080 board feet of S4S 2" x 8" pieces of lumber which are each 14 feet long. The planer chain worker must put 180 pieces in each standard package load.

a) How many standard package loads would be needed to fill the order of 10,080 board feet?

Definitions : Board feet -- a unit of lumber measurement one foot long, one foot wide and one inch thick.
S4S -- surfaced on four sides by planing.
Standard package load -- specified so a particular order will be of standard size for ease of handling in shipment.

B. Problems without solutions.

4. A hardboard plant operates for three 8-hour shifts named A, B, and C. A days production in 1/8" measure for shift A was 224,000 ; shift B was 179,200; shift C was 224,000. The total production for the year prior to this day was 99,941,815. Find the total production for the year after this day.

Definitions : Hardboard -- wood chip fibers combined with chemicals and pressed into a solid panel.
1/8" measure-- standard hardboard measure unit one foot long, one foot wide, and 1/8 inch thick.

5. Find the number of 3/8 foot units in a stack of 4 x 8 plywood veneer which is 24 inches high. There is approximately 70 3/8 foot units in one inch of 4 x 8 veneer.

Definitions: 3/8 foot unit -- a standard plywood measure one foot long, one foot wide, and 3/8 inch thick.
Veneer -- thin sheets of wood cut from a log by a large lathe.
4 x 8 -- plywood sheet 4 feet wide and 8 feet long.

6. A truck load of alder trees for pulp wood is delivered to a paper mill. The loaded truck weight 74,540 pounds and the empty truck weighs 24,140 pounds. The driver-owner of the truck is paid $3.65 per ton for delivery of the load.

a) Find the total weight of the load and the trucker' pay.
b) The seller of the trees is paid by the cord which is figured on the basis of 5,000 pounds per cord. Find the number of cords in the truck load to the nearest hundredth.
Definitions: Cord - a unit of wood measurement 4 feet wide, 8 feet long and 4 feet high.

Complete solutions to B problems.

3. Since there are 180 pieces 2" x 8" x 4'
Therefore board measure per load $= \left(\frac{2" \times 8"}{12"}\right)(14')$

$= 1.33" \times 14'$

$= \left(18.66 \frac{\text{bd ft}}{\text{bd}}\right)(180 \text{ bd})$

$= 3{,}360 \frac{\text{board ft}}{\text{load}}$

Number of loads equals 10,080 bd ft $\quad 3{,}360 \frac{\text{bd ft}}{\text{load}}$

$= 3$ standard loads

4. Production for this day

224,000	standard	boards
179,200	"	"
224,000	"	"
627,200	"	"

Production for the year totals

99,941,815	standard	boards
+ 627,200	"	"
100,569,015	"	"

5. Since there are 70 3/8 ft units in one inch of 4' x8' veneer, the total number of units is:

$$\left(70 \frac{\text{units}}{\text{inch}}\right)(24") = 1680 \text{ units}$$

6. Load weight = 74,540 lbs - 24,140 lbs

= 50,400 lbs

Tons of load $= \frac{50{,}400 \text{ lbs}}{2{,}000 \frac{\text{lb}}{\text{ton}}} = 25.2$ tons

Pay for delivery $= (25.2 \text{ tons})\left(3.65 \frac{\$}{\text{ton}}\right) = \$91.98$

Cords in load $= \frac{54{,}000 \text{ lbs}}{5{,}000 \frac{\text{lbs}}{\text{cord}}} = 10.80$ cord

A. Problems with Solutions

1. If a sludge bed may be cleaned out by 24 men working 8 hours a day for 26 days, how long will it take 16 men if they work on the sludge bed 6 hours a day?

   Solution:

   At first glance this looks like the familiar work-problem of algebra courses, but it is really a simple cancellation problem of whole numbers.

   (24 men)(26 days)(8 hours) = 4,992 man-hours needed
   (16 men)(6 hours) = 96 man-hours per day

   $$\frac{4{,}992 \text{ man-hours}}{96 \text{ man-hours/day}} = 52 \text{ days}$$

2. The Miller Creek waste water plant consists of primary treatment units with anaerobic digestion of settled solids. The facility serves an approximate population of 20,000 people and no industry. What volume of digester gas could an operator expect at Miller Creek per day?

   Solution:

   The general rule of thumb for estimating volume of digester gas per day is the population value expressed in cubic feet, i.e., 20,000 people equals (approximately) 20,000 cubic feet of gas per day.

B. Problems without Solutions

3. A careless workman accidently closes the gas outlet valve on a digester containing 15,000 cubic feet of gas, at a pressure of 4 psi. Sludge is pumped into the digester before the closed valve is noticed. The gas in the digester has been reduced in volume until it now occupies only 2200 cubic feet. What is the increase in pressure?

B. Problems without Solutions (continued)

4. Divide the product of 15 times 45 times 16, by 12 times 30.

5. If the pumping rate is 20 gallons per minute, how many gallons of solids are added to the digester each day?

6. Over a period of six weeks, an operator runs a weekly suspended solids test on a sample of raw sewage. The suspended solids concentrations for the six weeks were 220 ppm, 180 ppm, 242 ppm, 196 ppm, 253 ppm, and 201 ppm. What is the average suspended solids concentrations for the period?

Complete Solutions to B Problems

3. This is an application of Boyles' law which states that the product of pressure and volume remains constant. I.e.,

$P V = P V$; p = new pressure

$$\frac{(15{,}000 \text{ cu ft})(4 \text{ lbs/sq in})}{2{,}200 \text{ cu ft}} = 27.27 \text{ lbs/sq in}$$

4. $$\frac{(15)(45)(16)}{(12)(30)} = \frac{10{,}800}{360} = 30$$

5. Note: Convert gallons/min to gallons/day

$$(20 \text{ gal/min})(60 \text{ min/hr})(24 \text{ hr/day}) = 28{,}800 \text{ gal/day}$$

6. Average concentration $= \frac{220 \text{ ppm} + 180 \text{ ppm} + 242 \text{ ppm} + 196 \text{ ppm}}{6} + \frac{233 \text{ ppm} + 201 \text{ ppm}}{6}$

$= 212$ ppm

A. Problems with Solutions

1. A sample plot of Douglas Fir shows the following:

Tree No.	Height	Age	Tree No.	Height	Age
1	64ft	37yrs	8	65ft	42yrs
2	74ft	41yrs	9	58ft	36yrs
3	59ft	35yrs	10	71ft	47yrs
4	66ft	44yrs	11	70ft	40yrs
5	68ft	40yrs	12	63ft	43yrs
6	62ft	40yrs	13	55ft	36yrs
7	64ft	38yrs			

Determine the average annual height growth. The average annual height growth is the average number of inches per year and can be found as follows:

Solution:

The average annual height growth is

$$\frac{\text{sum of height}}{\text{sum of ages}} = \frac{839\text{ft}}{519\text{yrs}} = 1.62 \text{ ft/yr.}$$

B. Problems without Solutions

2. The following information is found for a proposed sale area in the Ochoco National Forest.

Unit No.	Acres	Plots
1	156	17
2	33	4
3	20	2
4	122	13
5	16	2
6	59	6
7	83	9

a) Determine the total number of acres and plots.
Determine the average number of: (nearest whole number)
b) plots per unit
c) acres per unit
d) acres per plot

3. Complete the table and find total costs for a timber sale in the Deschutes National Forest.

		Units of Area	Costs per unit	Costs total
1. Machine	a) Piling	462	$55	
	b) Burning	462	$10	
2. Hand	a) Piling	15	$80	
	b) Burning	15	$10	
3. Other	a) Spur Road Landing & slash	-	-	$905
	b) Mapping & signing	-	-	$373
4. Supplemental Protection				$3307
5. Improvement				$239
6. Indirect costs				$22937
	Total Costs	-	-	

B. Problems without Solutions (continued)

4. Two alternative market plans are evaluated below. Each of the dollar amounts is in M bd-ft (1000 bd-ft).

	Plan A	Plan B
Stumpage Cost	$60	$40
Logging Costs	$28	$32
Manufacturing Costs	$48 (boards)	$42 (studs)
Market Value	$150 (constant)	$60 to $180

Assuming that the firm will be able to secure all of the product produced in either plan, what is the minimum market value for studs which would make it profitable to choose plan B instead of plan A?

5. The forest service rents a B-17 for fire retardant drops at $483 per flying hour and a B-26 at $190 per hour for the total operating costs of the planes.

a) If on a large fire the B-17 required 3 hours of flying time and the B-26 required 2 hours, what was the total cost to the forest service?

b) If on another fire the B-17 required 4 hours of flying time and two B-26's were used, one for 3 hours and another for 5 hours, what was the total cost to the forest service?

Each B-17 can make four 450 gallon drops before reloading at $75/drop while the B-26 can make only two 500 gallon drops, refilling at a cost of $83 per drop.

c) What is the total capacity of each aircraft?

d) If the B-17 made 8 drops on a fire and the B-26 made 4 drops on the same fire determine the total cost of retardant on the fire.

Complete solutions to B problems.

2. Solution:

a) 156acres + 33acres + 20acres + 122acres + 16acres +

+ 59acres + 83acres = 489 acres

17 plots + 4plots + 2plots + 13plots + 2plots +

6plots + 9plots = 53 plots

b) $\frac{53 \text{ plots}}{7 \text{ units}}$ = 8 plots/unit

c) $\frac{489 \text{ acres}}{7 \text{ units}}$ = 70 acres/unit

d) $\frac{489 \text{ acres}}{53 \text{ plots}}$ = 9 acres/plot

3. Solution:

1a) 462 x \$55 = \$25410
1b) 462 x \$10 = \$4620
1c) 15 x \$80 = \$1200
1d) 15 x \$10 = \$150

Total costs=

\$25410 + \$4620 + 1200 + \$150 + \$905 + \$373 + \$3307 + \$239 + \$22937 = \$59141

Level II

4. Solution:

Costs: Plan A- \$60 + \$28 + \$48 = \$136

Plan B- \$40 + \$32 + \$42 = \$114

Thus the profit on plan A would be \$150 - \$136 = \$14.

To make at least a similar profit on plan B the market value would have to be at least \$114 + \$14 = \$128.

Complete Solutions to B problems (continued)

5. a) (3 hrs)($483/hr) + (2 hrs)($190/hr) = $1,449 + $380 = $1,829

b) (4 hrs)($483/hr) + (3 hr + 5 hrs)($190/hr) = $1,932 + $1,520
= $3,452

c) B-17 (4 drops)(450 gal/drop) = 1,800 gals
B-26 (2 drops)(500 gal/drop) = 1,000 gals

d) (8 drops)($75/drop) + (4 drops)($83/drop) = $600 + $332
= $932

A. Problems with Solutions

1. In a handwriting examination the angle of inclination of the t's is measured with a protractor. The following readings (in degrees) are obtained: 44, 42, 47, 39, 48, 43, 46, 41, 49. Compute the average angle of inclination.

   Solution:

   You need to add up the angles and then divide by the number of angles recorded.

   $44^\circ + 42^\circ + 47^\circ + 39^\circ + 48^\circ + 43^\circ + 46^\circ + 41^\circ + 49^\circ = 399^\circ$

   There are 9 angles, so $399^\circ/9 = 44.33^\circ$
   The average angle of inclination is $44\ 1/3^\circ$

2. The F.B.I. fingerprint system now contains 48,351,425 criminal fingerprint cards. New cards are being received at a rate of 31,423 per day. How many fingerprint cards will be on file 3 years from now? (365 days per year)

   Solution:

   You need to find the number of cards received each year and then multiply by the number of years. Then add that answer to the number of cards already on file.

   (31,423 cards/day)(365 days) = 11,469,395 cards/year

   (11,469,395 cards/year)(3 years) = 34,408,185 cards

   48,351,425 cards + 34,408,185 cards = 82,759,610 cards

B. Problems without Solutions

3. The following impressions were picked up from a bookmaker's pad during a raid: $54,261, $2,271, $511, and $13,462. Assuming this to be business, what was the total value of the material on the pads?

B. Problems without Solutions (continued)

4. The following described articles of property were reported as stolen:

1 Singer portable sewing machine, gray in color with a serial number of 456723, value $137.00
1 Zenith floor model 21 inch television set, blonde wood cabinet with ball bearing wheels installed by owner after purchase, value $168.
1 Zenith AM and FM table radio, white plastic cabinet, serial number 427925, value $63.00.
1 GE steam iron, value $7.00.
1 Argus 127 flash type camera, value $13.00.
Miscellaneous cosmetics in a blue overnight travel case $25.00.
Miscellaneous linens, towels and spreads $35.00.

What is the total value of the stolen property?

5. The Police Department has 12 vehicles and for the month of June the following record of mileage was recorded:

Car No.	Mileage at start	Mileage at end
1	18451	23014
2	12134	14358
3	36278	37301
4	56348	61047
5	9835	14032
6	43437	45124
7	33138	36247
8	29946	31344
9	17834	18141
10	13347	14121
11	51134	51772
12	14835	17354

Find the mileage traveled by each of the Department Vehicles during the month of June and the total mileage of all vehicles.

B. Problems without Solutions (continued)

6. In a raid 85 lots of narcotics were confiscated, each had an estimated value of $38,540. What was the total value of the narcotics confiscated during the raid?

7. It was announced that the salaries of the police officers for the next year would be increased $36,498 for the 79 officers. What would be the average pay raise?

8. The national Crime Information Center received a daily average of messages during the last 6 months as follows: July, 12,113; August, 13,235; September, 15,354; October, 16,569; November, 15,093; and December, 18,354. How many messages were received during the last six months of the year?

B. Problems without Solutions (continued)

9. A pumper truck can empty a 150,000 gallon tank in four hours of continuous pumping. What is the gallon per minute (G.P.M.) rate of flow?

Complete Solutions to B Problems

3. You need to add up the amounts found on the pads found during the raid.

$54,261 + $2,271 + $511 + $13,462 = $70,505

The total of the amounts from the pads is $70,505

4. You need to add up the value of each stolen article.

$137 + $168 + $63 + $7 + $13 + $25 + $35 = $448

The total value of the stolen property is $448.

5. You need to find the difference between the "end mileage" and "starting mileage", and then add up all 12 differences.

Car No.	End Mileage	-	Starting Mileage	=	Difference
1	23014	-	18451	=	4563 miles
2	14358	-	12134	=	2224 "
3	37301	-	36278	=	1023 "
4	61047	-	56348	=	4699 "
5	14032	-	9835	=	4197 "
6	45124	-	43437	=	1687 "
7	36247	-	33138	=	3109 "
8	31344	-	29946	=	1398 "
9	18141	-	17834	=	307 "
10	14121	-	13347	=	774 "
11	51772	-	51134	=	638 "
12	17354	-	14835	=	2519 "
	Total of all 12 differences			=	27138 miles

6. Total value = (value of each lot)(number of lots)

= ($38,540)(85)

= $3,275,900

Complete Solutions to B Problems (continued)

7. Average pay raise = $\frac{\text{total amount of money}}{\text{number of officers}}$

$= \frac{\$36,498}{79} = \$462$

8. You need to add up the average number of messages shown for each month, and then divide by the number of days in these 6 months.

Month	No of Days	Average No. Messages
July	31	12113
August	31	13235
September	30	15354
November	30	15093
December	31	18354
Total days =	184	Total Msgs = 90718

Average number of messages per day = $\frac{\text{total messages}}{\text{total days}} = \frac{90718}{184}$

= 493.03 or about 493 per day

9. You need to change the four hours into minutes, and divide the number of minutes into the number of gallons.

Number of minutes = (number of hours)(60 minutes per hour)

= (4)(60) = 240 minutes

Gallons per minute (GPM) = $\frac{\text{number of gallons}}{\text{number of minutes}}$

$= \frac{150,000}{240} = 625$

WHOLE NUMBERS
Level I

Agriculture

A. Problems with solutions.

1. At $475 per acre what is the value of a 2,750 acre ranch?

Solution:

$$\left(\frac{\$475}{\text{acre}}\right)(2{,}750 \text{ acres}) = \$1{,}306{,}250$$

2. During the year Mr. Goss had the following income and expenses. Find the total of each and his profit.

Income:		Expenses:	
Milk sales	63,409	Machinery	$31,340
Crop sales	21,564	Interest	5,864
Hog sales	3,674	Repairs	10,103
Custom work	1,800	Gas & oil	8,115
Inventory Increase	5,102	Hired Labor	7,000
Farm Privileges	150	Seed	534
		Fertilizer	2,856
		Feed	9,304
		Depreciation	2,100

Solution:

Income : $63,409 + $21,564 + $3,674 + $1,800 + $5,102 + $150 = $95,699

Expenses: $31,340 + $5,864 + $10,103 + $8,115 + $7,000 + $534 + $2856 +

+ $9,304 + $2,100 = $77,216

Profit: $95,699 - $77,216 = $18,483

3. The annual depreciation using the straight line method on a $20,500 Tractor with a 10 year life and a $2,500 salvage value would be how many dollars?

Solution:

$$\frac{\$20{,}500 - \$2{,}500}{10} = \frac{18{,}000}{10} = \$1800$$

4. We have the following weights for 6 steers; 878 lbs, 907 lbs, 838 lbs, 1010 lbs, 1113 lbs and 930 lbs. a) What is the average weight? b) If 3,072 lbs of feed is consumed in 32 days, what is the feed consumption per day per steer? c) If the total gain was 576 lbs, what is the average daily gain per steer?

Solution:

a) 878 lb + 907 lb + 838 lb + 1010 lb + 1113 lb + 930 lb = 5676 lb.

b) $\frac{3{,}072 \text{ lb}}{32 \text{ days}} = 96 \text{ lb/day}$, $\frac{96 \text{ lb/day}}{6 \frac{\text{steers}}{\text{day}}} = 16 \text{ lb/steer}$

A. Problems with solutions, continued.

4. continued.

c) $\frac{576 \text{ lb}}{32 \text{ days}} = 18 \text{ lb/day}$ 18lb/day / 6 steers/day = 3 lb/steer.

B. Problems without solutions.

5. What would be the total expected cost of a 60 h.p. wheel tractor with an estimated new cost of $18,700 and an expected life of 14,000 hours with fuel cost being $2.00 per hour and repairs $1.00 per hour of operating time?

6. A gallon of oil has a volume of 231 cubic inches. If a drum held 55 gallons of oil, what is the volume of the tank in cubic inches?

7. One man with a two-horse team can cultivate 9 acres of corn a day. With a tractor and an 8-row cultivator he can cover 126 acres a day. How many men and horses would it take to do the work of one tractor?

8. How many chicks can be brooded under a rectangular hover measuring 8 ft x 10 ft, allowing 10 in^2/chick?

B. Problems without solutions.

9. A tank of fuel holds 540 gallons. Each day 3 tractors using 15 gallons of fuel will be filled from it, how many days would be the maximum between fillings of the large tank?

10. Last year the top 10 wheat producing states harvested 1.37 billion bushels of all types of wheat with 200,000 self-propelled combines. What average number of bushels of wheat were harvested per combine?

11. Mr. Goad made a stack of baled hay 5 bales wide, 124 bales long and 10 bales high. If the bales average 80 lbs. per bale, how many ton of hay are in the stack?

12. A foreman was told to spend not over $1,450. on baling twine. Each ball of twine costs $12.00 how many balls could he buy and how much money was left over?

13. Using the price of 29¢/ft^2, find the cost of a concrete driveway that is 124 ft. long and 8 ft. wide.

B. Problems without solutions.

14. Compute the number of cwt (hundred weight) of wheat held by a truck grain box measuring 30 ft. long, 8 ft. wide and 5 ft. deep when it is level full (1 ft^3 of wheat weighs 48 lbs.)

15. A rancher has a pickup truck which weighs 4,000 lbs. empty and is licensed to GVW 5,000 lbs. On one trip he brings home 10 bushel of bran and _____ bushel of oats to complete his legal load. 1 bushel barley = 48 lbs, 1 bushel bran = 20 lbs, 1 bushel oats = 32 lbs.

16. You are feeding out a pen of 100 steers, you weighed them **yesterday** and got the following figures.

Feeding period	32 days	
Total gain	9,600 pounds	(for feeding period)
Total feed	67,200 pounds	(for feeding period)
Feed cost is 6¢ per pound		

Please figure the following:

a. Average daily gain per steer _____ lbs
b. Feed consumption per day per steer _____ lbs
c. Cost per head per day $_____
d. Cost per pound gained $_____
e. Feed ratio (feed to gain) _____

Complete solutions to B problems.

5. cost = \$18,700 + (14,000)(\$2.00) + (14,000) (\$1.00)

cost = \$18,700 + \$28,000 + \$14,000

cost = \$60,700

6. $\left(\frac{231 \text{ cubic inches}}{\text{gallon}}\right)$ (55 gallon) = 12,705 cubic inches

7. $\frac{126 \text{ acres}}{9 \text{ acres}}$ = 14 times as many

(14)(1 man) = 14 men

(14)(2 horses) = 28 horses

8. (8 ft) $\left(\frac{12 \text{ in}}{\text{ft}}\right)$ = 96 in.

(10 ft) $\left(\frac{12 \text{ in}}{\text{ft}}\right)$ = 120 in.

$\frac{(96 \text{ in})(120 \text{ in})}{\frac{10 \text{ in}^2}{\text{chick}}}$ = 1,152 chicks

9. (3 tractors) $\left(\frac{15 \text{ gallons}}{\frac{\text{tractor}}{\text{day}}}\right)$ = $\frac{45 \text{ gallons}}{\text{day}}$

$\frac{540 \text{ gallons}}{\frac{45 \text{ gallons}}{\text{day}}}$ = 12 days

10. $\frac{1,370,000,000}{200,000}$ = 6,850 bu/combine

11. $\frac{(124 \text{ bales})(5 \text{ bales})\ (10 \text{ bales})(80 \text{ lbs})}{2,000 \frac{\text{lbs}}{\text{ton}}}$ = 248 tons

12. $\frac{\$1450.00}{\frac{\$12.00}{\text{ball}}}$ = 120 balls with \$10 left over

13. (124 ft.) (8 ft.) $\left(\frac{29¢}{\text{ft}^2}\right)$ = 28768¢ or \$287.68

Complete solutions to B problems.

14. Vol = (length)(width)(height)

= (30 feet) (8 feet) (5 feet) = 1200 ft^3

weight = $(1200\ \cancel{ft^3})\left(\frac{48\ \cancel{lbs}}{\cancel{ft^3}}\right)\left(\frac{cwt}{100\ \cancel{lbs}}\right)$ = 576 cwt

15. 1 bushel oats = 32 lbs.

1 bushel barley = 48 lbs.

1 bushel bran = 20 lbs.

5,000 lb - (4,000 lb + 10(48 lbs)+ 10 (20 lb))=

5,000 lb - (4,000 lb + 480 lb + 200 lb) =

5,000 lb - (4,680 lb) = 320 lbs

$\frac{320\ \cancel{lbs}}{\frac{32\ \cancel{lbs}}{bushel}}$ = 10 bushel

16. a. $\frac{9,600\ lbs}{(32\ days)\ (100\ steers)}$ = 3 lbs/day/steer

b. $\frac{67,200\ lbs}{(32\ days)(100\ steers)}$ = 21 lbs/day/steer

c. (6¢)(21) = 126¢ or $1.26

d. $\frac{\$1.26}{3}$ = $.42 = 42¢

e. $\frac{21\ \cancel{lbs/day/steer}}{3\ \cancel{lbs/day/steer}}$ = 7 to 1

A. Problems with Solutions

1. The following items are costs incurred by a self-employed logger with one employee who operates an average of 10 hours per day throughout the work season of 120 days. Determine the annual business cost and the cost per hour of operation due to the following items:

Business Liability Insurance	$ 443/yr
Workman's Compensation	700
Life Insurance ($50,000)	1,190
Office in home @ $25/mo x 12 mo.	300
Telephone in home.	240
Bookkeeping, Taxes, Attorney	500
Pick-up @ 17¢/mile x 25,000 miles. . . .	4,250
Firewagon @ $1000 divided over 10 yrs. .	100
Chain Saws & Small Tools	600
72 Chokers @ $25 each (3/4 in)	1,800
Moving Cost.	250
Other Costs.	OPEN

Solution: Total annual business cost $10,379

$$\text{Business cost per hour of operation} = \frac{\text{annual cost}}{1{,}200 \text{ hrs}}$$

$$= \frac{\$10{,}379}{1{,}200 \text{ hrs}}$$

$$= \$8.65 \text{ per hour}$$

B. Problems without Solutions

2. Complete the labor cost report below.

Timber Fallers	35 hrs @ $13.50	_____
Buckers	67 hrs @ $11.75	_____
Cat Skinners	150 hrs @ $7.00	_____
Over-time Cat Skinners	15 hrs @ $11.00	_____
Chokermen	40 hrs @ $3.50	_____
TOTAL		_____

B. Problems without Solutions (continued)

3. Fill in the blanks below and cross-check.

Volume in Board Feet, Decimal Scale

Log #	Gross Scale	Deductions for defects	Net Scale
1	660	0-	_____
2	30	0-	_____
3	660	60-	_____
4	160	50-	_____
5	140	40-	_____
6	1,010	470-	_____
7	2,060	20-	_____
8	430	0-	_____
9	760	330-	_____
10	300	10-	_____
Totals	_____	_____	_____

Cross-check total net scale _____

4. Bureau of Labor statistics indicate that a family of four requires an income of $10,644 per year to live at the 'intermediate level'. A self-employed logger desires to be in this class. His single employee doesn't live so well. The employee's (choker-setter) wages are $3.82 per hour plus fringe benefits which are equivalent to $1.80 per hour. The employee does receive time and one-half for his overtime, however (based on an 8 hour workday). Determine the logger's total labor cost on an hourly basis, assuming that the work season is 120 days and the average number of hours worked each day is 10.

B. Problems without Solutions (continued)

5. The Oregon State Department of Forestry furnishes fire protection for 16.3 million acres of forests. An average of 1,057 fires are controlled annually. The average number of acres of forest burned each year during the last six years was 14,641 acres. Fire control expenditures total $674,000 annually.

   a) Determine the average number of acres of forest burned per fire each year to the nearest acre.

   b) Determine the average per acre cost for fire suppression each year to the nearest ten cents.

6. The formula commonly used for determining the board foot content of sawed lumber is:

$$\text{Board Feet} = \frac{(\text{Thickness, in})(\text{Width, in})(\text{Length, ft})}{12}$$

Compute the total volume of board ft and the total price for the following items of lumber: (TBF means thousand board feet)

# Pieces	Size	Price/TBF
129	3 x 6 x 16	$ 169.00
256	2 x 4 x 18	170.50
346	2 x 8 x 20	185.00
87	2 x 6 x 14	170.00
44	2 x 4 x 12	170.00

2.

Timber Fallers	(35 ~~hrs~~)	($13.50/~~hr~~)	= $ 472.50
Buckers	(67 ~~hrs~~)	($11.75/~~hr~~)	= $ 787.25
Cat Skinners	(150 ~~hrs~~)	($7.00/~~hr~~)	= $1,050.00
Overtime Cat Skinners	(15 ~~hrs~~)	($11.00/~~hr~~)	= $ 165.00
Chokermen	(40 ~~hrs~~)	($3.50/~~hr~~)	= $ 140.00
		Total	$2,614.75

3.

Log#	Net Scale
1	660 - 0 = 660
2	30 - 0 = 30
3	660 - 60 = 600
4	160 - 50 = 110
5	140 - 40 = 100
6	1,010 - 470 = 540
7	2,060 - 20 = 2,040
8	430 - 0 = 430
9	780 - 330 = 450
10	300 - 10 = 290
Total	5,250

	Gross Scale	Deductions
Total	6,230	980

Cross-check of Net Scale Total
6,230 - 980 = 5,250

4. Owner's Labor Cost

$$\frac{\$10,644}{1,200 \text{ hours}} = \$8.87/\text{hr}$$

Employee's Labor Cost
Straight time

(1,200 hrs)($3.82/hr + $1.80/hr) = (1,200 ~~hrs~~)($5.62/~~hr~~)
= $6,744.00

Overtime

He averaged 10 hours a day, which is 2 hours overtime per day, or 240 total overtime hours.

(240 ~~hr~~)($1.91/~~hr~~) = $458.40

$$\text{Average rate} = \frac{(\$6,744 + \$458.40)}{1,200 \text{ hrs}} = \frac{\$7,202.40}{1,200 \text{ hrs}} = \$6.00/\text{hr}$$

Total Labor Cost = $8.87/hr + $6.00/hr = $14.87 per hour

5. Average acres burned per fire = $\frac{14,641 \text{ acres}}{1,057 \text{ fires}}$ = 13.85 acres/fire

or 14 acres per fire

Average per acre cost = $\frac{\$674,000/\text{yr}}{14,641 \text{ acres}}$

= $46.04 per acre per year

6.

# Pieces	Size	Board ft	Price/TBF	Cost
129	3 x 6 x 16 ft	3,096	$169.00	$ 523.22
256	2 x 4 x 18 ft	3,072	170.50	523.78
346	2 x 8 x 20 ft	9,227	185.00	1,706.93
87	2 x 6 x 14 ft	1,218	170.00	207.06
44	2 x 4 x 12 ft	352	170.00	59.84
Totals 862		16,965		$3.020.83

A. Problems with solutions.

1. Mrs. Brown is on a liquid diet. Her lunch consisted of 200 cc of soup, 150 cc of jello, and 120 cc of hot tea. Total amount of fluids for this meal was:

Solution:
$$\begin{array}{r} 200 \text{ cc} \\ 150 \text{ cc} \\ +\ 120 \text{ cc} \\ \hline 470 \text{ cc} \end{array}$$

2. Mrs. Vaughn is receiving one capsule of Achromicin 250 mgm t.i.d. Her new drug order is to increase the dosage to 500 mgm t.i.d. How many more capsules will Mrs. Vaughn receive today than she received yeaterday?

Solution: Since t. i. d. means " three times a day"

$$\frac{250 \text{ mg}}{500 \text{ mg}} = \frac{3 \text{ capsules}}{N}$$

$$(250 \text{ mg})(N) = (3 \text{ capsules})(500 \text{ mg})$$

$$N = \frac{(3 \text{ capsules})(500 \text{ mg})}{250 \text{ mg}}$$

$$= 6 \text{ capsules}$$

3. Miss Arnold is urged to drink 3000 cc of fluid a day. Yesterday she drank two glasses of juice which were 240 cc each, three glasses of milk which were 240 cc each, and five glassed of water which were 240 cc each. How many more cc were needed to reach 3000 cc?

Solution: Total amount drunk:
$$\begin{array}{rl} (2 \text{ glasses})(240\text{cc/glass}) & = 480 \text{ cc} \\ (3 \text{ glasses})(240\text{cc/glass}) & = 720 \text{ cc} \\ (5 \text{ glasses})(240\text{cc/glass}) & = 1200 \text{ cc} \\ \hline & 2400 \text{ cc} \end{array}$$

Since 3000 cc was desired, she needs to drink
$$\begin{array}{r} 3000\text{cc} \\ -2400\text{cc} \\ \hline 600\text{cc} \text{ more} \end{array}$$

B. Problems without solutions.

4. Miss Layne received Demerol IM the following times: 100 mgm at 8 AM, 50 mgm at 12:30 PM, and 75 mgm at 4 PM. The total amount given was _____.

B. Problems without solutions.

5. The dose of Aspirin is gr. V. How many doses of Aspirin are there in grXXX ?

6. Mr. Time is to receive Para-Aminosalicylic Acid 8 tablets t.i.d. How many should be ordered for a week's supply?

7. Mr. Carroll is receiving intramuscualr injections of 50,000 U of Penicillin every 4 hours. He will receive _____ U of Penicillin in 48 hours.

B. Problems without solutions.

8. Mr. Tycin is to recieve Elixir of Terpin Hydrate with Codiene, dram I q.i.d. The doctor gave him a 4 ounce bottle to take home. How many teaspoonsfull should be taken each time?

   How many doses are contained in the bottle?

   How many cc would be given in 24 hours?

9. Mrs. Lennen is to receive sulfacetamide 1.0 gm. every 4 hours. Tablets are labeled 0.5 gm.

   How many are given for each dose?

   How many are given in 24 hours?

10. Mr. Niles is to receive Ilotycin 200 mg. every 4 hours for 5 days. Tablets are labeled gr 1 1/2.

    How many tablets are needed for each dose?

    How many tablets would be needed in the five-day course of therapy?

B. Problems without solutions.

11. Miss Williams is to receive Dihydrostreptomycin 0.5 Gm every 6 hours from a vial labeled "2 cc = 1.0 Gm." How much would be given for one dose? _____ cc.

How many vials would be needed for 6 days of therapy?

12. The label reads Dexedrine gr $\overline{V}$. How many tablets would be used to give gr $\overline{XV}$?

13. The label reads: 5 cc contains gr VII ss of drug. To give gr XV you would use _____ cc of solution.

B. Problems without solutions.

14. Quinicline comes in 80 mg/cc. You must give 200 mg. How many cc's would you give (to the nearest tenth cc)?

15. The order was left for Miss Marcy to have Terramycin Hydrochloride 1.0 gm by I.V. push every 12 hours for the next 48 hours, then 0.5 gm. every 12 hours the next 48 hours. Vials are prepared with 250 mg of dry powder.

    How much diluent should be added to give 1.0 gm dose?

    How much diluent should be added to give 0.5 gm dose?

    How many vials will be needed in all?

16. The order has been left for Mr. Bay to have Sulfathiazole gr XXX stat, followed by gr XV every 4 hours for 24 hours, then gr VII ss every 4 hours for 4 days. Label reads 0.5 gm.

    How many tablets would be given stat?

    How many tablets would be given in the first 24 hours dosage?

    What is the total number of tablets needed for the course of therapy?

Complete solutions to B problems.

4. Total amount = 100 mgm + 50 mgm + 75 mgm

= 225 mgm

5. Since V is 5 and XXX is 30 , the question is how many 5 gr doses are there in 30 grains

$$\frac{30 \text{ grains}}{5 \text{ grains}} = 6 \text{ doses}$$

6. Weeks supply = (8 tablets)(3 times a day)(7 days/week)

= 168 tablets/ week

7. He receives injections every 4 hrs. Total number of injection =

$$\frac{48 \text{ hrs}}{4 \text{ hrs}} = 12 \text{ injections}$$

(12 injections)(50,000 U/injection) = 600,000 U

8. Since 1 teaspoon is 1 dram, he should take 1 teaspoon at a time.

Number of doses $= \left(8 \frac{\text{dr}}{\text{oz}}\right)(4 \text{ oz}) = (32 \text{ drams})\left(\frac{1 \text{ dose}}{1 \text{ dram}}\right) = 32$ doses

Since q.i.d. means "4 times a day"

Number of cc's $= (4)(1 \text{ dram})\left(\frac{15 \text{ cc}}{4 \text{ drams}}\right)$

= 15 cc's

9. By inspection she would take 2 tablets per dose.

Tablets per day = (2 tablets/ dose) (24 hrs) (1 dose/4 hours)

= 12 tablets

10. $\frac{200 \text{ mg/dose}}{1.5 \text{ gr/tablet}}$ since 1.5 gr = 100 mg

$$\frac{200 \text{ mg/dose}}{100 \text{ mg/tablet}} = 2 \text{ tablets/dose}$$

Number of tablets = (2 tablets/dose)(24 hrs/day)(5 days)(1dose/4 hrs)

= 60 tablets

Complete solutions to 8 problems.

11. Amount per dose = 1 cc (by inspection)

$$\text{Amount needed} = \left(\frac{\frac{1}{2}\text{ vial}}{\text{dose}}\right)(6\ \text{day})\ (24\ \text{hr/day})\ (1\ \text{dose/6 hrs})$$

$$= 12 \text{ vial}$$

12. Since V = 5 and XV = 15

$$\text{Number of tablets} = \frac{15\ \text{gr}}{5\ \text{gr/tablets}} = 3 \text{ tablets}$$

13. gr VII ss = 7.5 grains so the proportion is

$$\frac{5\text{ cc}}{7.5\text{ gr}} = \frac{x}{15\text{ gr}} \qquad (7.5\text{ gr})(x) = (5\text{ cc})(15\text{ gr})$$

$$x = \frac{(5\text{ cc})(15\text{ gr})}{7.5\text{ gr}}$$

$$x = 10 \text{ cc}$$

14. $$\frac{200\text{ mg}}{\frac{80\text{ mg}}{\text{cc}}} = 2.5 \text{ cc}$$

15. As a matter of nursing knowledge one would know that she would probably add one cc of diluent to each vial. This can vary under different, specific conditions.

a) $\frac{1\text{ gm}}{250\text{mg/vial}} = 4$ vials

b) $\frac{0.5\text{ gm}}{250\text{mg/vial}} = 2$ vials

c) (4 vials/dose)(48hrs)(1 dose/12 hrs) +(2 vials/dose)(48hrs) (1dose/12 hrs)

= 16 vials + 8 vials

= 24 vials

16. a) grXXX = 30 grains 30 grains /7.5 grains/tablet) = 4 tablets

Complete solutions to B problems.

16. continued.

b. gr XV = 15 grains $\left(\frac{15 \text{ grains}}{4 \text{ hours}}\right)$ (24 hrs) $\left(\frac{2 \text{ tablets}}{15 \text{ grains}}\right)$ = 12 tablets

c. gr VII ss = 7.5 grains $\left(\frac{7.5 \text{ grains}}{4 \text{ hours}}\right)\left(\frac{1 \text{ tablet}}{7.5 \text{ grains}}\right)\left(\frac{24 \text{ hrs}}{\text{day}}\right)$ day

(4 days) = 24 tablets

Total = 4 tablets + 12 tablets + 24 tablets = 40 tablets.

Technical terms applying to mapper problems.

Mapper- A person employed by an electric utility company who's job it is to read maps of utility installations and list materials which are to be removed and installed as specified by the engineers.

ACSR_ Aluminum core steel reinforced electric conductor

AAC - All aluminum conductor

c/o - Load break cut-outs

CR - Contract rental pole

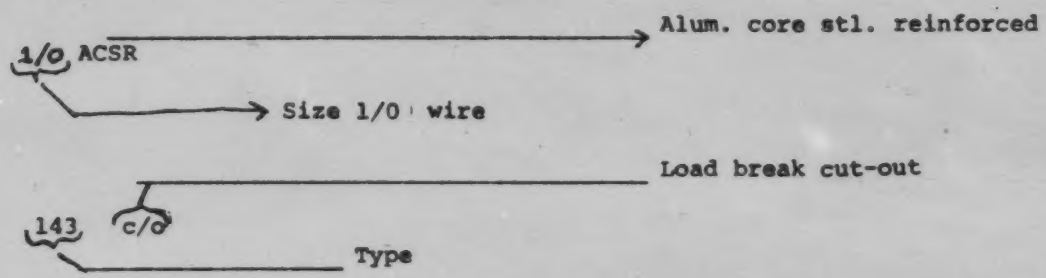
BHD - Bare, hard drawn copper wire

Tx - Triplex

B - Bare

P - Pole

Examples of how the above abbreviations are used.



Source: Electric Utility Company

A. Problems with solutions

Refer to Technical Terms Sheet for explaination of abbreviations.

1. To prepare a cost estimate for an electric utility project, a mapper has tabulated the following materials list. You are to find the totals for each type of material tube removed and added.

	Removals							
Area Section	6B	4B	2ACSR	1/0ACSR	142 c/o	135 c/o	40' Poles	
C-21-15 B4	800'	10'	390'	400'	3		1	
C-21-15 B3	2680'	200'	1980'	1340'	1	1	1	
C-21-15 C2			100'					
C-21-16 A4	2740'		1370'	1370'				
C-21-16 A3	3140'	1460'	640'	640'			1	
C-21-16 D2	540'	810'					1	
Totals								
	Additions							
	795AAC	556AAC	4/0AAC	142 c/o	45'pole	40'pole	Sw	Cap
B4		1200'	400'			1		
B3	1290'	4020'	1770'	1	2	1	1	
C2	1550'		500'			4		
A4		4110'	1370'					
A3		5880'	1960'	1			1	
D2		810'	270'	1			1	
A2		3990'	1330'	3	4		1	1
Totals								

Solution:

6B - 800' + 2680' + 2740' + 3140' + 540' = 9900'
4B - 10' + 200' + 1460' + 810' = 2480'
1 2ACSR - 390' + 1980' + 100' + 1370' + 640' = 4480'
1/0ACSR - 400' + 1340' + 1370' + 640' = 3750'
142c/0 - 3+1 = 4
135c/o - 1
40' Poles - 1 + 1 + 1 + 1 = 4
795AAC - 1290' + 1550' = 2840'
556AAC - 1200' + 4020' + 4110' + 5880' + 810' + 3990' = 20,010'
4/oAAC - 400' + 1770' + 500' + 1370' + 1960' + 270' + 1330' = 7600'
142c/o - 1 + 1 + 1 + 3 = 6
45'Pole - 2 + 4 = 6
40'Pole - 1 + 1 + 4 = 6
SW - 1 + 1 + 1 + 1 = 4
Cap - 1

A Problems with solutions

2. For an electric utility project, a mapper lists the following:

Remove	Add
2 - 6B 640'	3-556 AAC 640'
1 - 1/o ACSR 640'	1-4/0 AAC 640'
1 - 2 AcSR 640'	3-556 AAC 1320'
3 - 4B (Ser) 260'	1-4/0 AAC 1320'
2 - 6B Pri 930'	1-40'P #1993
2 - 4B Pri 340'	1-142 c/0
1 - 40' P # 1993	3-556 AAC 270'
3 - 4B (Ser) 270'	1-4/0 AAC 270'
2 - 6B Pri 270'	4-40' P #6410, 6411, 6412, 6413
	3-556 AAC 1330'
	1-4/0 AAC 1330'
	1-300 KVA Cap Bank on Pole 6411
	3-143c/o (3-100s)
	1- Powerdyne 600A Serv. on P 6412

You are to find totals of each type of material to be removed and added.

Solution:

Remove	6B	2x640' = 1280' 2x930' = 1860' 2x270' = 540' 3680' = Total
Remove	4B	3x260' = 780' 2x340' = 680' 3x270' = 810' 2270' = Total
Remove	1/0 ACSR	1x640' = 640' 640' = Total
Remove	2 ACSR	1x640' = 640' 640' = Total
Remove	40' Pole #1993	1x1 = 1 = Total

A. Problems with solutions continued

#2. continued:

Add	556 AAC	3x640' = 1920' 3x1320'=3960' 3x 270' = 810' 3x1330' = 3990' 10,680' = Total
Add	4/0 AAC	1x640' = 640' 1x1320'= 1320' 1x 270'= 270' 1x1330'= 1330' 3560' = Total
Add	142 c/o	1x 1 = 1 = Total
Add	143 c/o	3x 1 = 3 = Total
Add	40' Pole #1993 #6410, 11, 12, 13	1x 1 = 1 4x 1 = 4 5 = Total
Add	300Kva Cap. Bank on pole 6411	1x 1 = 1 = Total
Add	Powerdyne 600A serv. on pole 6412	1x 1 = 1 = Total

B. Problems without solutions.

3. A spool of # 14-2 TF with ground conductor is sent to a job where 167 feet is used. The spool, originally holding 500 feet, previously had 47 feet used.

How much wire is left on thes spool?

B. Problems without solutions

4. A utility company mapper lists the following:

Add	3 - 556 AAC	920'
	1 - 4/0 AAC	920'
	3 - 367 - 3 AL - VG	1660'
Remove	1 - 4 ACSR	40'
	2 - 4 B Pri.	490'
	1 - 4 ACSR	510'
	2 - 4 B Sec.	160'
	1 - 4 B Sec.	460'
	1 - 135 c/0	
Add	3 - 556 AAC	910'
	1 - 4/0 AAC	910'
Add	3 - 795 AAC	330'
	1 - 4/0 AAC	330'
	1 - 75' Pole	#6526
	2 - 40' P	6525, 6524
	3-795 AAC	490'
	1 - 142 c/0	F-100
	1 - 4/0 AAC	490'

You are to find the totals of each type of wire, and other items to be added and removed.

B. Problems without solutions

5. Line currents in a residential wiring job are:

Line A	Neutral	Line B
57 amperes		57 amperes
6 "		6 "
12 "		12 "
3 "		12 "
		3 "

What is the total current in:

a) Line A? _____

b) Line B? _____

6. For an electric utility project, a mapper lists the following items:

Remove	3	1/0 ACSR - 20'
	1	2 ACSR - 20'

Add	3	556 AAC - 20'
	1	4/0 AAC - 20'

Remove	3	1/0 ACSR - 1310'
	3	4B 660'
	1	2 ACSR 650'
	1	142 c/o

B. Problems without solutions

6. continued:

Add	1	Powerdyne 600 A service #1869 on P 2388
	3	556 AAC - 1310'
	1	4/0 AAC - 1310'
	2	142 c/0 - F100

Remove

1	142 c/o, 1-144 c/o
3	4B - 210'
1	2 ACSR 710'
3	1/0 ACSR 920'
4	ACSR 480'
1	40' Pole #4246

You are to list the totals of each type of wire to be removed.
List the totals of each type of wire to be added.
List the totals of each of the other items to be removed.
List the totals of each of the other items to be added.

B. Problems without solutions

7. Computed electrical wiring loads for a residential job are:

General lighting	4500 watts
Small appliance load	3000 "
Laundry	1500 "
Range	8000 "

What is the ;

a) Total without range load? _____

b) Total (with range) load? _____

c) Net total if the electrical code allows a 3900 watt reduction in the total (with range) load? _____

Complete solutions to B problems

3. Original amount of wire 500 feet

Wire used 47 ft
+167 ft

Total used 214 ft

amount remaining 500 ft
-214 ft
286 ft answer

4.

Remove	4ACSR	1 x 40' = 40' 1 x 510 =510' 550' = Total
Remove	4B	2 x 490' = 980' 2 x 160'=320' 1 x 460'= 460' 1760 = Total
Add	556 AAC	3 x 920' = 2760' 3 x 556' = 1668' 4428'= Total
Add	4/0 AAC	1x 920' = 920' 1 x 910' = 910' 1 x 330' = 330' 1 x 490' = 490' 2650 = Total
Add	795 AAC	3x 330 ' = 990' 3 x 490' =1470' 2460' = Total
Add	367-3AL-VG	3 x 1660' = 4980' 4980'= Total
Add	135 c/o	1 x 1 = 1 1 = Total
Add	142 c/o	1 x 1 = 1 1 = Total
Add	Poles 75' #6526 40' #6524, #6525	 1 x 1 = 1 = Total 2 x 1 = 2 = Total

Complete solutions to B problems

Solution:

5. a) Line A

57 A (amperes)
6 A
12 A
3 A
Total, 78 A; ans.

b) Line B

57 A
6 A
12 A
12 A
3 A
Total, 90 A; ans.

6.

Remove	1/0 ASCR		3x20' = 60' 3x1310' = 3930' 3x 920' = 2760' 6750' = Total
Remove	2ACSR		1 x 20' = 20' 1 x650' = 650' 1 x710' = 710' 1380' = Total
Remove	4B		3 x 660' = 1980' 3x 210' = 630' 2610' = Total
Remove	AcSR	(size unspecified)	4x 480'= 1920' 1920' = Total
Remove	142 c/0		1x 1 = 1 1x 1 = 1 2 = Total
Remove	144 c/o		1 x 1 = 1 1 = Total
Add	556 AC		3 x 20' = 60' 3 x1310 = 3930' 3990 = Total
Add	4/0 AAC		1 x 20' = 20' 1 x1310 =1310' 1330" = Total
Add	Powerdyne 600 A service # 1869		1 x 1 = 1 = Total
Add	142 c/0 - F- 100		2 x 1 = 2 = Total

Complete solutions to B problems

7. Solution:

a) General Lighting---------- 4500 W (Watts)
Small appliance ---------- 3000 W
Laundry---------- 1500 W
9000 W

9000 W Total w/o range from pt a)
b) Range---------- 8000 W
17,000W answer

17,000 W total with range from pt b
c) Reduction---------- -3900 W
13,100 W answer

A. Problems with Solutions

1.

Weekly Sales Report

Dept	Mon	Tue	Wed	Thu	Fri	Sat	Total
X	254	198	300	273	251	321	
Y	197	143	201	184	225	251	
Z	83	72	179	125	96	156	
Totals							

Fill in the blanks in this report and check your answers.

Solution:

Add the numbers across.

Dept X = 254 + 198 + 300 + 273 + 251 + 321 = 1,597

Dept Y = 197 + 143 + 201 + 184 + 225 + 251 = 1,201

Dept Z = 83 + 72 + 179 + 125 + 96 + 156 = 711

Add the numbers down.

Mon	Tue	Wed	Thu	Fri	Sat
254	198	300	273	251	321
197	143	201	184	225	251
+ 83	+ 72	+ 179	+ 125	+ 96	+ 156
534	413	680	582	572	728

As a check, the sum of the sums across should equal the sum of the sums down.

1,597
1,201
+ 711
3,509

534 + 413 + 680 + 582 + 572 + 728 = 3,509

A. Problems with Solutions (continued)

2. A merchant in one year had sales of $25,608. The inventory of the goods on hand at the beginning of the year was $5,682; and at the end of the year was $3,169. He purchased merchandise during the year at a cost of $12,468. If his selling expenses for the year were $6,829 and in addition he spent $1,026 for advertising, did he gain or lose and how much?

Solution:

Amount gained = Sales - Expenses

To get total expenses, we will treat the drop in inventory as an expense.

Total expenses = ($5,682 - $3,169) + $12,468 + $6,829 + $1,026
= $22,836

Amount gained = $25,608 - $22,836 = $2,772

3. An appliance manufacturer sold 56,583 refrigerators during the first quarter (3 months) of the year. Second quarter sales were 65,325 units. What was the average sales per month for the first half of the year?

Solution:

We need to find the total number of units sold and divide by 6.

Total sold = 56,583 refrigerators + 65,325 refrigerators
= 121,908 refrigerators

$$\text{Average} = \frac{121{,}908 \text{ refrigerators}}{6 \text{ months}} = 20{,}318 \text{ refrigerators/month}$$

4. Irwin Miller is the owner of Miller's Paint Store. His inventory on October 1 showed a stock of merchandise amounting to $11,984. His purchases in October amounted to $2,842; and his sales totaled $4,173. His inventory on October 31 was $12,189.

a) Find the cost of the goods sold during the month.

b) Find the gross profit for the month.

Solution:

(a) Cost of goods sold = total cost of goods handled - cost of goods left
= ($11,984 + $2,842) - $12,189
= $14,826 - $12,189
= $2,637

A. Problems with Solutions (continued)

4. Solution: (continued)

(b) Gross profit = Sales - Cost of goods sold

= $4,173 - $2,637

= $1,536

B. Problems without Solutions

5. A retail furniture dealer buys a studio couch for $125. At what price should he sell it if he desires a gross profit of $95?

6. The packing department of Ajax Industry is required to keep records of the shipping weight, net weight and packing weight of all items shipped. The following form must be completed and turned into the records department.

	Shipping Weight	Net Weight	Difference
Item A	1,500 lbs	1,343 lbs	
Item B	2,800 lbs	2,551 lbs	
Item C	675 lbs	619 lbs	
Total			

Complete this table and check your totals.

7. Sales for the Rockwell Mfg Company amounted to $376,000 last year. During the first 6 months of last year the monthly sales were $37,000; $15,000; $26,500; $37,500; $28,750 and $32,500, respectively. How much were the sales for the remainder of the year?

B. Problems without Solutions (continued)

8. Evans Company had 10,700 gear parts in stock. During January, 8,978 were sold. How many should be left in stock?

9. Last year, the sales of E.I. Hicks were $31,482. His inventory at the beginning of the year was $10,344. His purchases during the year amounted to $21,246. His inventory at the end of the year was $9,868.

   (a) Find the cost of the goods sold during the year.

   (b) Find the gross profit for the year.

10. Johnson Company began the year with an inventory valued at $41,049. During the year they purchased additional goods for $356,285. At the end of the year the remaining inventory was worth $57,372. What was the value of the goods which were sold?

B. Problems without Solutions (continued)

11. A stationer's merchandise inventory was $16,843 on October 1 and $17,355 on December 31. Sales for the quarter were $21,466, and the purchases were $13,927. Find the gross profit for the quarter. (1 quarter = 3 months.)

12. A millinery dealer bought 20 dozen ladies' hats for $900. He sold 100 hats at $6.00, 80 hats at $5.00 and the rest at $4.00. Find the total amount of his gross profit.

Complete Solutions to B Problems (continued)

9. Cost of goods sold = Cost of goods available for sale - End Inventory

But,

Cost of goods available for sale = Beginning inventory + Purchases

Cost of goods available = $10,344 + $21,246 = $31,590

Cost of goods sold = $31,590 - $9,868 = $21,722

10. Cost of goods sold = Cost of goods available - Ending inventory

But,

Cost of goods available = Beginning inventory + Purchases

= $41,049 + $356,285 = $397,334

Cost of goods sold = $397,334 - $57,372 = $339,962

11. Gross profit = Sales - Cost of goods sold

Cost of goods sold = Cost of goods available - Ending inventory

= ($16,843 + $13,927) - $17,355

= $30,770 - $17,355 = $13,415

Gross profit = $21,466 - $13,415

= $8,051

12. Gross profit = Sales - Cost of goods sold

Compute total sales:

Sales = (100 ~~hats~~)($6/~~hat~~) + (80 ~~hats~~)($5/~~hat~~) + (240 hats - 180 hats) ($4/hat)

= $600 + $400 + (60 ~~hats~~)($4/~~hat~~)
= $600 + $400 + $240
= $1,240

Gross profit = $1,240 - $900 = $340

Complete Solutions to B Problems

5. Selling Price = Cost + Profit

Selling Price = $125 + $95 = $220

6. Item A: 1,500 lbs - 1,343 lbs = 157 lbs

Item B:= 2,800 lbs - 2,551 lbs = 249 lbs

Item C: 675 lbs - 619 lbs = 56 lbs
Sum of differences 462 lbs

Check this by adding shipping weights:

1,500 lbs + 2,800 lbs + 675 lbs = 4,975 lbs

Then subtract total net weights:

1,343 lbs + 2,551 lbs + 619 lbs = 4,513 lbs

Difference: = 4,975 lbs - 4,513 lbs = 462 lbs

7. Sales for last 6 months = year's sales - first 6 months sales

You need to add monthly sales for first 6 months:

$37,000
15,000
26,500
37,500
28,750
+ 32,500
$177,250

Thus,

Sales for last 6 months = $376,000 - $177,250
= $198,750

8. Ending Inventory = Beginning inventory - Number sold

= 10,700 gear parts - 8,978 gear parts

= 1,722 gear parts

A. Problems with solutions.

The average end area method is used in determining the quantities of excavation or fills in both highways and building site locations.

The end areas are usually determined by the coordinate method:

$$A = \frac{1}{2}\left[\frac{Y_1}{X_1}\ \ \frac{Y_2}{X_2}\ \ \ldots\ldots\ \frac{Y_n}{X_n}\ \ \frac{Y_1}{X_1}\right] \text{ or}$$

$$\frac{1}{2}\left[(X_1Y_2) + X_2Y_3 + X_3Y_4 \ldots\ldots + X_nY_1) - (X_2Y_1 + X_3Y_2 + X_4Y_3 \ldots\ldots + X_1Y_n)\right]$$

Using the above equation evaluate the following field notes:

1. $\frac{0}{0}$ $\frac{0}{+10}$ $\frac{15}{+45}$ $\frac{18}{+35}$ $\frac{20}{0}$ $\frac{17}{-20}$ $\frac{24}{-60}$ $\frac{0}{-15}$

Solution:	(0')	(0')	= 0 sq ft	(10')	(0)	=	0 sq ft
	(10')	(15')	= 150 sq ft	(45')	(0')	=	0 sq ft
	(45')	(18')	= 810 sq ft	(35')	(15')	=	525 sq ft
	(35')	(20')	= 700 sq ft	(0')	(18')	=	0 sq ft
	(0 ')	(17')	= 0 sq ft	(-20')	(20')	=	-400 sq ft
	(-20')	924')	= -480 sq ft	(-60')	(17')	=	-1020 sq ft
	(-60')	(0')	= 0 sq ft	(-15')	(24')	=	-360 sq ft
	(15')	(0')	= 0 sq ft	(0 ')	(0')	=	0 sq ft
	Sum		1180 sq ft				-1255 sq ft

$A = 1/2\left[\text{Sum}_1 - \text{Sum}_2\right]$

$= 1/2\left[1180 \text{ sq ft} + 1255 \text{ sq ft}\right]$

$= 1/2\left[2435 \text{ sq ft}\right]$

$= 1217.5 \text{ sq ft}$

2. $\frac{0}{+4}$ $\frac{10}{+13}$ $\frac{10}{+8}$ $\frac{11}{+4}$ $\frac{9}{0}$ $\frac{9}{-4}$ $\frac{7}{-10}$ $\frac{0}{-4}$

Solution:							
	(4')	(10')	= 40 sq ft	(13')	(0)	=	0 sq ft
	(13')	(10')	= 130 sq ft	(8')	(10)	=	80 sq ft
	(8')	(11')	= 88 sq ft	(4')	(10)	=	40 sq ft
	(4')	(9')	= 36 sq ft	(0')	(11)	=	0 sq ft
	(0')	(9')	= 0 sq ft	(-4')	(9)	=	-36 sq ft
	(-4')	(7')	= -28 sq ft	(-10')	(9)	=	-90 sq ft
	(-10')	(0')	= 0 sq ft	(-4')	(7)	=	-28 sq ft
	(-4')	(0')	= 0 sq ft	(4')	(0)	=	0 sq ft
	Sum		266 sq ft				-34 sq ft

A. Problems with solutions.

2. continued. $A = 1/2 \left[Sum_1 - Sum_2 \right]$

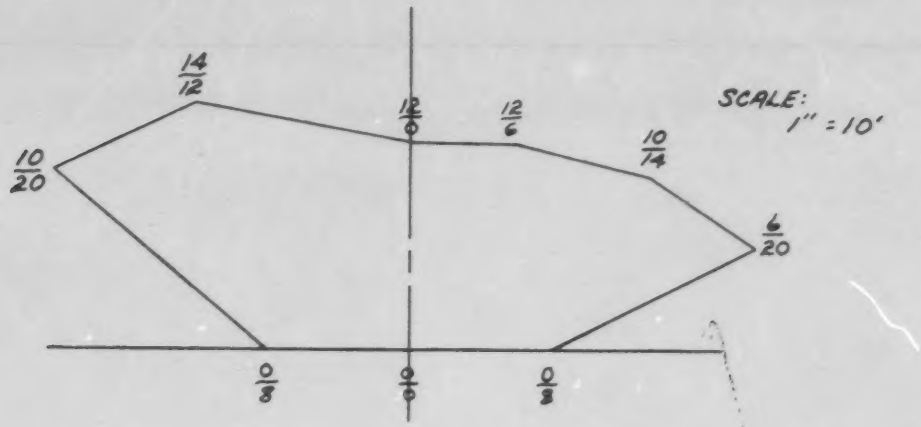
$= 1/2 \left[266 \text{ sq ft} + 34 \text{ sq ft} \right]$

$= 1/2 \ 300 \text{ sq ft}$

$= 150 \text{ sq ft.}$

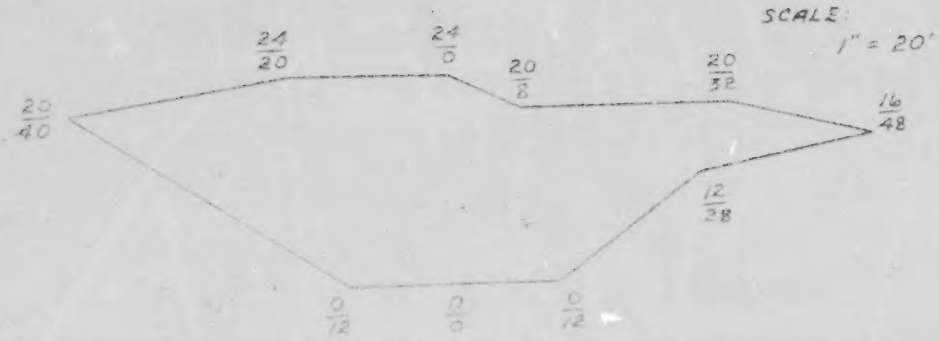
B. Problems without solutions.

3. Set up an appropriate coordinate system and evaluate the areas of the following irregular shapes:



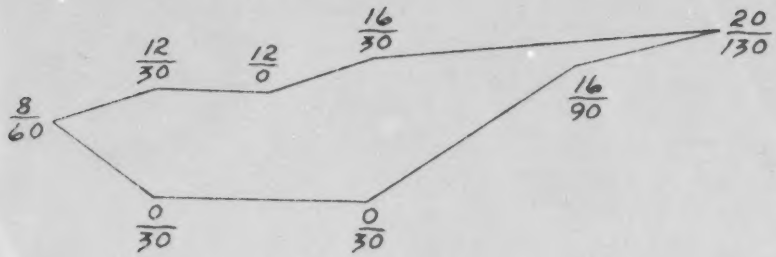
B. Problems without solutions.

1.



B. Problems without solutions

6.



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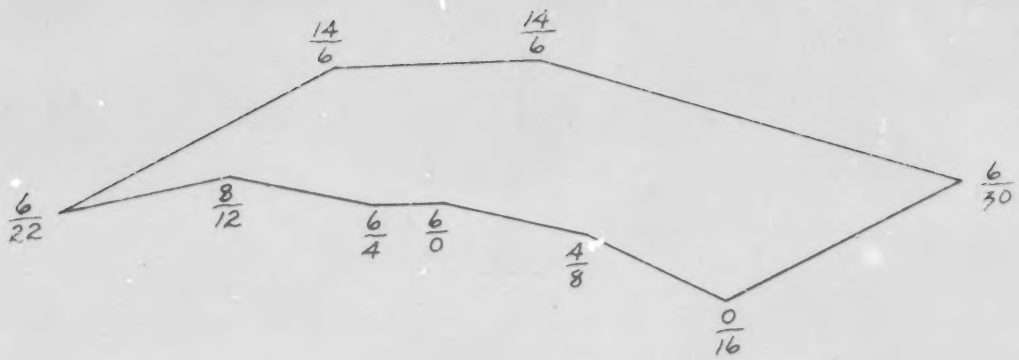


B. Problems without solutions.

8.

Item No.	Work or Material	Quantity	Unit	Unit Price	Amount
1F	Clearing and Grubbing		Lump sum	$16,000.00	$16,000.00
2F	Deleted				
3F	Foundation Excavation, Common Spring Creek Diversion Dam	1,500	cu.yd.	$ .75	$
4F	Foundation Excavation in Rock, Spring Creek Diversion Dam	75	cu.yd.	$ 7.50	$
5F	Approach Bay Excavation Spring Creek Diversion Dam	1,020	cu.yd.	$ 1.00	$
6F	Unclassified Excavation, Spring Creek Diversion Channel	43,800	cu. yd.	$ .82	$
7F	Common Excavation, Spring Creek Diversion Channel	36,500	cu.yd.	$ .45	$
8F	Bulkhead, Spring Creek Diversion Dam, Principle Spillway		Lump sum	$ 250.00	$
9F	Compacted Embankment Class A Earthful, Spring Creek Diversion Dam	6,460	cu.yd.	$ 1.20	$
10F	Concrete Mix for Grout, Spring Creek Diversion Channel	1,055	cu.yd.	$ 19.00	$
11F	Class B concrete, Spring Creek Diversion Dam Emergency Spillway	287	cu.yd.	$ 56.00	$
12F	Class B Concrete, Spring Creek Diversion Dam Principle Spillway	206	cu.yd.	$ 55.00	$
13F	Class B concrete, Transition, Spring Creek Diversion Channel	85	cu.yd.	$ 80.00	$
14F	Class B Concrete, Approach Bay Retaining Wall, Spring Creek Diversion Dam	26	cu.yd.	$ 110.00	$
			TOTAL BID		$

Complete solutions to B problems.

3.

(0')	(0')	=	0 sq ft	(8')	(0')	=	0
(8')	(6')	=	48 sq ft	(20')	(0')	=	0
(20')	(10')	=	200 sq ft	(14')	(6')	=	84
(14')	(12')	=	168 sq ft	(6')	(10')	=	60
(6')	(12')	=	72 sq ft	(0')	(12')	=	0
(0')	(14')	=	0 sq ft	(-12')	(12')	=	-144
(-12')	(10')	=	-120 sq ft	(-20')	(14')	=	-280
(-20')	(0')	=	0 sq ft	(-8')	(10')	=	80
(-8')	(0')	=	0 sq ft	(0')	(0')	=	0
Sum			368 sq ft	Sum			-360 sq ft

$A = 1/2\ (sum_1 - sum_2)$
$= 1/2\ (368 - (-360))$
$= 1/2\ (728)$
$= 364$ sq ft

4.

0	0	12	16	20	20	24	24	20	0
0	12	28	48	32	8	0	-20	-40	-12

(12')	(0')	=	0 sq ft
(28')	(0')	=	0 sq ft
(48')	(12')	=	576 sq ft
(32')	(16')	=	512 sq ft
(8')	(20')	=	160 sq ft
(0')	(20')	=	0 sq ft
(-20')	(24')	=	-480 sq ft
(-40')	(0')	=	-960 sq ft
(-12')	(20')	=	-240 sq ft
Sum			- 432 sq ft
Sum			1984 sq ft

$A = 1/2\ [Sum_1 - Sum_2]$
$= 1/2\ [1984 \text{ sq ft} + 432 \text{ sq ft}]$
$= 1/2\ [2416 \text{ sq ft}]$
$= 1208$ sq ft

Complete solutions to B problems.

5.

0	0	10	17.5	20	25	30	30	25	20	10	0
0	20	50	80	100	60	30	0	-80	-110	-50	-20

(0')	(0')	=	0	Sq ft		(20')	(0')	=	0	sq ft
(20')	(10')	=	200	sq ft		(50')	(0')	=	0	sq ft
(50')	(17.5')	=	875	sq ft		(80')	(10')	=	800	sq ft
(80')	(20')	=	1600	sq ft		(100')	(17.5')	=	1750	sq ft
(100')	(25')	=	2500	sq ft		(60')	(20')	=	1200	sq ft
(60')	(30')	=	1800	sq ft		(30')	(25')	=	750	sq ft
(30')	(30')	=	900	sq ft		(0')	(30')	=	0	sq ft
(0')	(25')	=	0	sq ft		(- 80')	(30')	=	-2400	sq ft
(-80')	(20')	=	-1600	sq ft		(-110')	(25')	=	-2750	sq ft
(-110')	(10')	=	-1100	sq ft		(- 50')	(20')	=	-1000	sq ft
(-50')	(0')	=	0	sq ft		(- 20')	(10')	=	-200	sq ft
(-20')	(0')	=	0	sq ft		(0')	(0')	=	0	sq ft
Sum			5175	sq ft		Sum			-1850	sq ft

$A = 1/2 [sum_1 - sum_2]$
$= 1/2 [5175 \text{ sq ft} - (-1850 \text{ sq ft})]$
$= 1/2 [7025 \text{ sq ft}]$
$= 3512.5 \text{ sq ft}$

6.

0	0	16	20	16	12	12	8	0
0	30	90	130	30	0	-20	-60	-30

(30')	(0')	=	0	sq ft
(90')	(0')	=	0	sq ft
(130')	(16')	=	2080	sq ft
(30')	(20')	=	600	sq ft
(0')	(16')	=	0	sq ft
(-30')	(12')	=	-360	sq ft
(-80')	(12')	=	-720	sq ft
(-30')	(8')	=	-240	sq ft
(0')	(0')	=	0	sq ft
sum			1360	sq ft

$A = 1/2 [sum_1 - sum_2]$
$= 1/2 [4480 \text{ sq ft} - 1360 \text{ sq ft}]$
$= 1/2 [3120 \text{ sq ft}]$
$= 1560 \text{ sq ft}$

Complete solutions to B problems.

7.

6	4	0	6	14	14	6	8	6
0	8	16	30	6	-6	-22	-12	-4

(0')	(4')	=	0	sq ft		(8')	(6')	=	48	sq ft
(8')	(0')	=	0	sq ft		(16')	(4')	=	64	sq ft
(16')	(6')	=	96	sq ft		(30')	(0')	=	0	sq ft
(30')	(14')	=	420	sq ft		(6')	(6')	=	36	sq ft
(6')	(14')	=	84	sq ft		(- 6')	(14')	=	84	sq ft
(- 6')	(6')	=	- 36	sq ft		(-22')	(14')	=	308	sq ft
(-22')	(8')	=	-176	sq ft		(-12')	(6')	=	-72	sq ft
(-12')	(6')	=	- 72	sq ft		(- 4')	(8')	=	-32	sq ft
(- 4')	(6')	=	- 24	sq ft		(0')	(6')	=	0	sq ft
sum			292	sq ft		sum			- 180	sq ft

$A = 1/2 \left[\text{sum}_1 - \text{sum}_2\right]$
$= 1/2 \left[292 \text{ sq ft} - (-180 \text{ sq ft})\right]$
$= 1/2 \left[472 \text{ sq ft}\right]$
$= 236 \text{ sq ft}$

8.

1F	Lump sum	$16,000.00
2F	Deleted	
3F	(1,500 cu ~~yds~~)($0.75/~~cu yd~~)	$ 1,125.00
4F	(75 ~~cu yds~~)($7.50/~~cu yd~~)	$ 562.50
5F	(1,020 ~~cu yds~~)($1.00/~~cu yd~~)	$ 1,020.00
6F	(43,800 ~~cu yds~~)($0.45/~~cu yds~~)	$35,916.00
7F	(36,500 ~~cu yds~~)($0.45/~~cu yds~~)	$16,425.00
8F	Lump sum	$ 250.00
9F	(6,460 ~~cu yds~~)($1.20/~~cu yd~~)	$ 7,752.00
10F	(1,055 ~~cu yds~~)($19.00/~~cu yds~~)	$20,045.00
11F	(287 ~~cu yds~~)($56.00/~~cu yds~~)	$16,072.00
12F	(206 ~~cu yds~~)($55.00/~~cu yds~~)	$11,330.00
13F	(85 ~~cu yds~~) ($80.00/~~cu yd~~)	$ 6,800.00
14F	(26 ~~cu yds~~) ($110.00/~~cu yd~~.)	$ 2,860.00
	Total Bid	$136,157.50

A. Problems with Complete Solutions

1. The Machine Shop ordered 25 bars of C.R.S. (cold rolled steel) #1020, 5/8" in diameter; 18 bars 1" in diameter; 18 bars 1 1/4" in diameter; 5 bars 2" in diameter; and 1 bar 3" in diameter. How many bars did the Machine Shop order?

   Solution:

   Need the total sum of all bars.

   Number of bars = 25 bars + 18 bars + 18 bars + 5 bars + 1 bar

   = 67 bars

2. A machinist has a bar of steel 3" in diameter, weighing 364 lbs. If 176 lbs are used for making die stocks, how many pounds are left?

   Solution:

   Need difference between total weight and weight of piece used.

   Weight left = 364 lbs - 176 lbs = 188 lbs

3. If it takes 40 minutes to set up a job and cut the teeth, on a gear blank, how many hours will be required to complete a job of cutting 33 such gear blanks? (60 min = 1 hr)

   Solution:

   Need to multiply number of gear blanks times the time it takes to do one blank and divide by 60.

$$\frac{(40 \text{ min/blank})(33 \text{ blanks})}{60 \text{ min/hr}} = \frac{1{,}320 \text{ min}}{60 \text{ min/hr}} = 22 \text{ hrs}$$

B. Problems without Complete Solutions

4. A grinding wheel is 18" in circumference. How many turns does it make per minute if the surface speed is 915 feet per minute? (12 in = 1 ft)

   Solution:

B. Problems without Complete Solutions (continued)

5. A machine shop buys 876 lbs of 1/2" diameter steel; 1,567 lbs of 1" diameter steel; 675 lbs of 3" diameter steel; 5,743 lbs of flat stock rectangular shape 1" x 2"; 250 lbs 1/8" x 2'; 365 lbs 1/2" square. What is the total pounds purchased?

   Solution:

6. In the Northwestern Machine shop there are: 16 lathes each weighing 2,145 lbs; 4 milling machines each weighing approximately 2,460 lbs; 2 drill presses each weighing 450 lbs. What is the entire weight of these machines on the floor?

   Solution:

7. In the pattern shop, 67 screws 3/4 #10 F.B.H. (Flat Bright-Headed) were used from a box containing one gross (144). How many were left in the box?

   Solution:

8. One dozen 11/32" diameter metal drills costs $18.00. How much should one drill cost?

   Solution:

B. Problems without Complete Solutions (continued)

9. A power hack saw operates at 126 strokes per minute. It works continuously for 420 min (7 hrs). How many strokes does it make on the job?

Solution:

10. An unfinished casting weighs 473 lbs. 117 lbs are removed by a shaper during the finishing processes. How much does the casting weigh when finished?

Solution:

11. A group of castings are made from patterns for a lathe. The base weighs 432 lbs; the tail stock 35 lbs; the head stock 63 lbs; the face plate 3 lbs; the bed 217 lbs; and the pulley 13 lbs. What is the total weight of the parts?

Solution:

12. A grinding wheel is 37" in circumference. When operating, it makes 3,750 revolutions per minute (rpm). A worker sharpens 26 tool bits, running the wheel 53 minutes. How many inches of grinding wheel does he use?

Solution:

B. Problems without Complete Solutions (continued)

13. For metal fitting (also known as metal bench work) a worker is told to cut a piece of flat steel stock 1/8" x 2" into pieces 17", 23", 9", 32" and 15" long. How long a piece of flat steel does he need if 1" is wasted in cutting the pieces?

Solution:

14. A machine shop receives a load of steel bars which are 12 feet long. Included in this load are 17 bars of 3/4" x 3/4" angle iron. How many pieces 7" long can be cut from the 17 bars if 21" are wasted in making the cuts?

Solution:

4. Need to change feet per minute to inches per minute and then divide by the circumference of the wheel.

$$\text{Number of turns} = \frac{(915\ \cancel{ft}/\text{min})(12\ \cancel{in}/\cancel{ft})}{18\ \cancel{in}/\text{turn}}$$

$$= 610 \text{ turns per minute}$$

5. Need sum of weights of each item.

$$\text{Total weight} = 876 \text{ lbs} + 1{,}567 \text{ lbs} + 675 \text{ lbs} + 5{,}743 \text{ lbs} + 250 \text{ lbs} + 365 \text{ lbs}$$

$$= 9{,}476 \text{ lbs}$$

6. Need to multiply number of machines times the weight of each machine, then we need the total weights of all of these.

Lathes (16 machines)(2,145 lbs/machine)	34,320 lbs
Milling machines (4 machines)(2,460 lbs/machine)	9,840 lbs
Drill press (2 machines)(450 lbs/machine)	900 lbs
Total weight of machines	45,060 lbs

7. Need difference between one gross and number used.

$$\text{Number screws left in box} = 144 \text{ screws} - 67 \text{ screws}$$

$$= 77 \text{ screws}$$

8. One dozen = 12 drills, total cost divided by number of drills will give cost per drill.

$$\text{Cost per drill} = \frac{\$18.00}{12 \text{ drills}} = \$1.50 \text{ per drill}$$

9. Need to multiply number of strokes per minute times number of minutes of operation.

$$\text{Number of strokes} = (126 \text{ strokes/minute})(420 \text{ minutes})$$

$$= 52{,}920 \text{ strokes}$$

Complete Solutions to B problems (continued)

10. Need difference between the two weights.

Weight = 473 lbs - 117 lbs = 356 lbs

11. Need sum of weights of each casting.

Total weight = 432 lbs + 35 lbs + 63 lbs + 3 lbs +

217 lbs + 13 lbs

= 763 lbs

12. Need to multiply number of rpm times the circumference of grinding wheel and that product times number of minutes the grinding wheel runs.

Total length of grinding wheel used = L

L = (3,750 ~~rev~~/~~min~~)(37 in/~~rev~~)(53 ~~min~~)

= 7,353,750 in

13. Need the sum of individual pieces and waste.

Length of steel bar = 17" + 23" + 9" + 32" + 15" + 1"

= 97" = 8 ft 1 in

14. Need to change the 17 bars that are 12 feet long to inches, subtract 21", and then divide by the 7" length per piece.

$$\text{Number of pieces} = \frac{(17\ \text{bars})(12\ \text{ft/bar})(12\ \text{in/ft}) - 21"}{7\ \text{in/piece}}$$

$$= \frac{2{,}448\ \text{in} - 21\ \text{in}}{7\ \text{in/piece}}$$

$$= \frac{2{,}427\ \text{in}}{7\ \text{in/piece}}$$

= 346.71 pieces

therefore, 346 pieces 7 inches long can be cut

A. Problems with Solutions

1. In order to construct a certain pipe system, 5 elbows, 7 tees and 2 couplings are needed. Also needed are 12 pieces of pipe of lengths: 5", 7", 12", 13", 2", 17", 27", 3", 31", 42" and 9". Each elbow costs 27¢, each tee costs 37¢, each coupling costs 17¢, and the pipe costs 12¢ per lineal foot. How much will the material for the system cost?

   Solution:

   Cost of elbows = (5 ~~elbows~~)(\$0.27/~~elbows~~) = \$1.35

   Cost of tees = (7 ~~tees~~)(\$0.37/~~tee~~) = \$2.59

   Cost of couplings = (2 ~~couplings~~)(\$0.17/~~coupling~~) = \$0.34

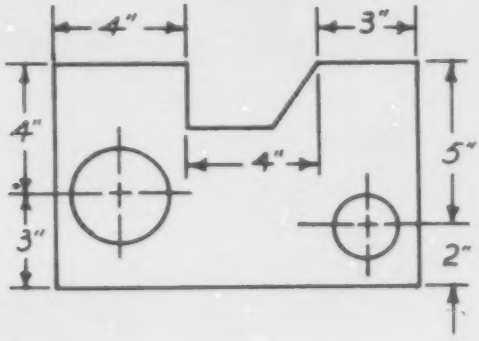
   Length of pipe = 5" + 7" + 12" + 13" + 2" + 17" + 27" + 3" + 31" + 42" + 9" = 168 in

   $$(168 \text{ in})\left(\frac{1 \text{ ft}}{12 \text{ in}}\right) = 14 \text{ ft}$$

   Cost of pipe = (14 ~~ft~~) (\$0.12/~~ft~~) = \$1.68

   Total cost = \$1.35 + \$2.59 + \$0.34 + \$1.68 = \$5.96

2. A piece of metal is to be cut according to the diagram. What is the overall length and width of the piece?



   Solution:

   Length = 4" + 4" + 3" = 11 in

   Width = 3" + 4" = 2" + 5" = 7 in

A. Problems with Solutions (continued)

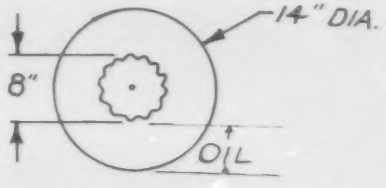
3. A tank of oil contains 450 gallons. Each day 90 gallons are used. How many days will it take to use up the oil?

Solution:

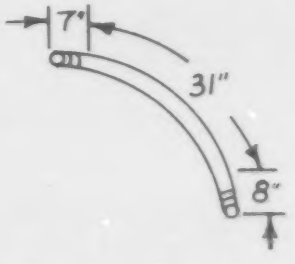
$$\text{Time to use up oil} = \frac{450 \text{ gals}}{90 \text{ gals/day}} = \frac{450 \cancel{\text{gals}} \times \text{day}}{90 \cancel{\text{gals}}} = 5 \text{ days}$$

B. Problems without Solutions

4. A sprocket and chain assembly is enclosed in a circular oil bath as shown in the diagram. The sprocket has a diameter of 8" and the oil bath has a diameter of 14". What must the depth of oil in the bath be to achieve lubrication?



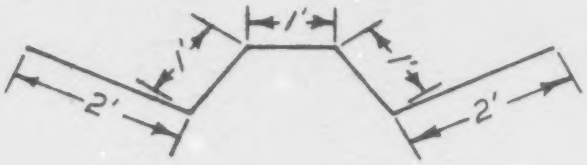
5. What length of pipe would be needed to form a bend like the one in the drawing? An extra inch of pipe is needed in order to form the bend.



6. A piece of pipe 72" long is to be bent in a 90° arc with a straight portion 3" on each end. How long is the arc?

B. Problems without Solutions (continued)

7. A steel rod is cut and welded to match the drawing. Approximately how many lineal feet of rod would be needed to make the finished product?



8. A pipe fitter is going to place a wrinkle bend in a piece of pipe 2' long. He wants a 45° bend and he wishes to accomplish the bend with 9 wrinkles. How many degrees are there in each wrinkle?

9. A circular tank has a volume of 1085 cubic feet. If 1 gallon of liquid occupies approximately 7 cubic feet of space, how many gallons of liquid will the tank hold?

10. A gallon of oil has a volume of 231 cubic inches. If a tank held 420 gallons of oil, what is the volume of the tank in cubic inches?

B. Problems without Solutions (continued)

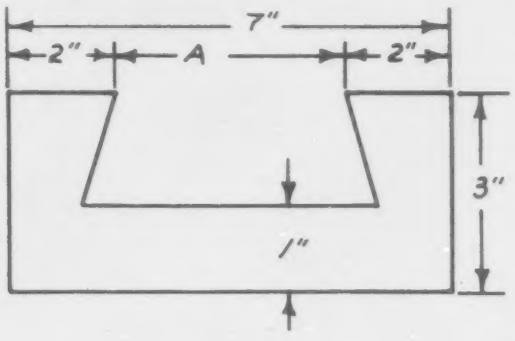
11. A spherical tank has a surface area of 351 sq ft. If 1 gallon of a rust-preventative paint will cover 13 sq ft, how many gallons of the paint will be needed to cover the tank?

12. From a piece of hexagon stock, 5 pieces are to be cut off. If the pieces are 11", 9", 13", 23" and 15", what is the total length of rod required. Include 1" for rod wasted in making the cuts.

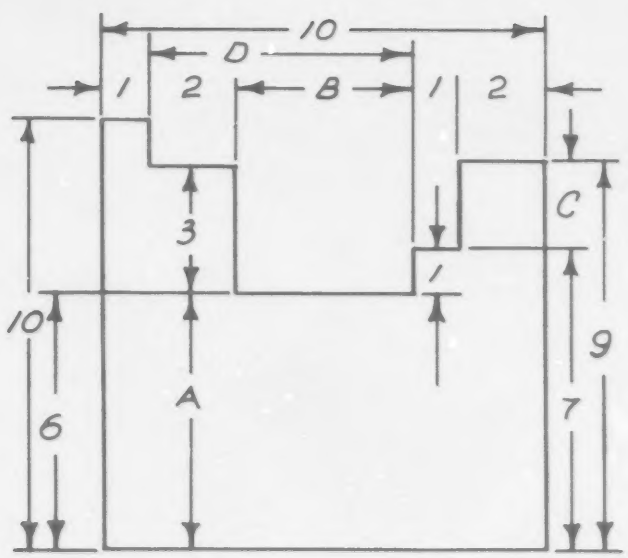
13. It is desired to lay out a group of machines in a straight line. If 2' are required between machines and there are 5 machines of 12, 7, 8, 13 and 15 feet lengths, what is the total length of the line?

B. Problems without Solutions (continued)

14. Find A and the depth of the dovetail.



15. Find A, B, C, and D.
(all dimensions are in inches)



B. Problems without Solutions (continued)

16. A foreman was given $2,375.00 to buy tools. Each tool costs $16.00. How many tools did he buy? How much money was left over?

17. A bearing of a test machine failed after 467,245,800 cycles were completed. If the machine was operating at 4,200 cycles per minute, after how many minutes did the failure occur?

Complete Solutions to B Problems

4. Depth must be at least $\frac{14" - 8"}{2} = 3$ in

5. Length = 7" + 31" + 8" + 1" = 47"

$$(47 \text{ in})\left(\frac{1 \text{ ft}}{12 \text{ in}}\right) = 3 \text{ ft } 11 \text{ in}$$

6. arc length = 72" = 2(3") = 66"

$$(66 \text{ in})\left(\frac{1 \text{ ft}}{12 \text{ in}}\right) = 5 \text{ ft } 6 \text{ in}$$

7. length = 2' + 1' + 1' + 2' + 1' = 7 ft

8. Degrees in each wrinkle = $\frac{45^\circ}{9 \text{ wrinkles}} = 5^\circ$ per wrinkle

9. Gallons = $\frac{1085 \text{ cu ft}}{7 \text{ cu ft/gal}} = \frac{(1085 \text{ cu ft} \times \text{gal})}{7 \text{ cu ft}} = 155$ gals

10. Volume = $(420 \text{ gal})\left(\frac{231 \text{ cu in}}{\text{gal}}\right) = 97{,}020$ cu in

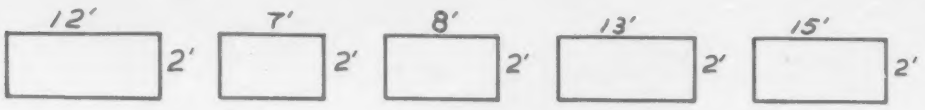
11. Gallons of paint = $\frac{351 \text{ sq ft}}{13 \text{ sq ft/gal}} = \frac{(351 \text{ sq ft} \times \text{gal})}{13 \text{ sq ft}} = 27$ gals

12. Length = 11" + 9" + 13" + 23" + 15" + 1" = 72"

$$(72 \text{ in})\left(\frac{1 \text{ ft}}{12 \text{ in}}\right) = 6 \text{ ft}$$

Complete Solutions to B Problems (continued)

13. Length of line = 12' + 7' + 8' + 13' + 15' + 4(2') = 63'



14. A = 7" - 2" - 2" = 3 in

Depth of dovetail = 3" - 1" = 2"

15. A = 6 in

C = 9" - 7" = 2 in

D = 10" - 1" - 1" - 2" = 6 in

B = D - 2" = 6" - 2" = 4 in

16. Number of tools = 148

$$\frac{\$2,375.00}{\$16.00} = 148 + \$7.00$$

Money left = $7.00

17. $$\text{Minutes of operation} = \frac{467,245,800 \text{ cycles}}{4,200 \text{ cycles/min}} = \frac{(467,245,800 \text{ cycles} \times \text{min})}{4,200 \text{ cycles}}$$

$$= 111,249 \text{ min}$$

A. Problems with Solutions

1. The initial advance for an engine is 8°. The total vacuum advance is 12° and the mechanical advance is 16°. What is the maximum advance? What is the advance at low RPM and WOT?
Definitions: RPM: revolutions per minute; WOT: wide open throttle

Solution:

Maximum advance = $8^{\circ} + 12^{\circ} + 16^{\circ} = 36^{\circ}$

At low RPM and open throttle neither the vacuum nor the mechanical advance would be activated, therefore, 8° would be the total.
At high RPM and WOT the mechanical advance owuld apply but not the vaccum advance. The total would be $8^{\circ} + 16^{\circ} = 24^{\circ}$

2. An engine has just been tuned but is lifeless. You find that the mechanic who did the job set the timing 8° behind TDC instead of 8° ahead of TDC. How much is the engine out of tune?
Definitions: TDC: top dead center

Solution:

(8° behind to 8° ahead)

$8^{\circ} + 8^{\circ} = 16^{\circ}$ out of tune

3. A rule of thumb states that a car with a pressure cap on the radiator will boil at three times the cap poundage plus 212 F. What temperature would a 1973 Cadillac reach with a 17 PSI radiator cap?

Solution:

Temp = $(17)(3^{\circ}) + 212^{\circ} = 263^{\circ}$

B. Problems without Solutions

4. If an automobile repair shop obtains engine overhaul parts at a shop cost of $96.12 and retails them on the job for $156.82, what is the total amount of profit from the parts? What is the overall discount to the shop?

5. If the camshaft gear in a Chevrolet 350 engine has 38 teeth, how many teeth does the crankshaft gear have?

Complete Solutions to B Problems

4. Profit on parts = \$156.82 - \$96.12 = \$60.70

Discount to shop = $\frac{\$60.70}{\$156.82}$ = 0.387 = 39%

5. Crankshaft gear = $\frac{38 \text{ teeth}}{2}$ = 19 teeth

A. Problems with Solutions

1. A pile of lumber contains 205 boards 10 feet long, 83 boards 12 feet long, 172 boards 8 feet long, and 16 boards 16 feet long.

   (a) How many boards are in the pile?

   (b) How many linear feet of lumber are in the pile?

   Solution:

   (a)
   $$\begin{array}{r} 205 \text{ boards} \\ 83 \quad " \\ 172 \quad " \\ +\ 16 \quad " \\ \hline 476 \text{ boards} \end{array}$$

   (b)
   $$\begin{array}{r} 205 \times 10' = 2050' \\ 83 \times 12' = 996' \\ 172 \times 8' = 1376' \\ 16 \times 16' = 256' \\ \hline 4678 \text{ linear feet} \end{array}$$

2. From a board 96 inches long 3 pieces are to be cut; 24 inches, 28 inches, and 36 inches in length. How long is the piece that remains?

   Solution:

   24" + 28" + 36" = 88" 96" - 88" = 8-inches piece remains

3. Where would you place a 54 inch cabinet to be centered on a 9' 8" wall?

   9' 8" = (9 ~~ft~~)(12 in/~~ft~~) + 8 in = 108" + 8" = 116"

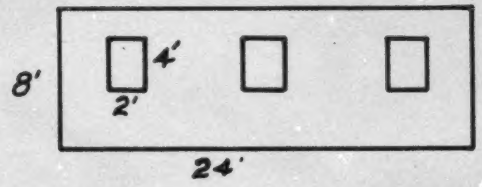
   Then, the center of the wall is 116"/2 = 58" from either edge.

   Since half of the cabinet will be on each side of the center of the wall, 54"/2 = 27" will be on each side.

   So 58" - 27" = distance from wall to edge of cabinet = 31 inches

A. Problems with Solutions

4. Find the number of 4' x 8' sheets of sheetrock needed as plaster base on the wall shown.



Solution:

When sheetrock is used as a plaster base, the number of joints need not be considered. Since remnants can be used above and below the openings, the opening areas are subtracted.

Area of total wall = (Base)(Height)

= (24')(8') = 192 sq ft

Area of openings = (Number of openings)(Base)(Height)
= (3)(2')(4')
= (3)(8 sq ft)
= 24 sq ft

Area to be covered = 192 sq ft - 24 sq ft = 168 sq ft

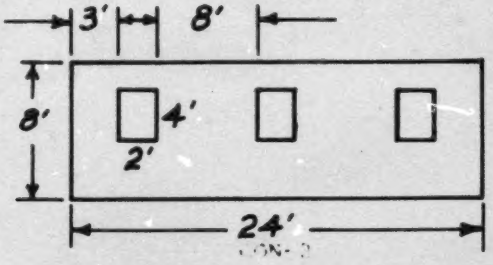
$$\text{Number of sheets needed} = \frac{\text{Area to be covered}}{\text{Area of panel}}$$

$$= \frac{168 \text{ sq ft}}{(4')(8')}$$

$$= \frac{168 \text{ sq ft}}{32 \text{ sq ft}}$$

= 5 1/4 sheets of sheetrock

5. Determine the number of 4' x 8' sheets of sheetrock needed for the wall in the accompanying figure.



A. Problems with Solutions (continued)

5. (continued)

In calculating the number of sheets of sheetrock, the number, size, and location of openings must be considered since the minimum number of joints is desirable.

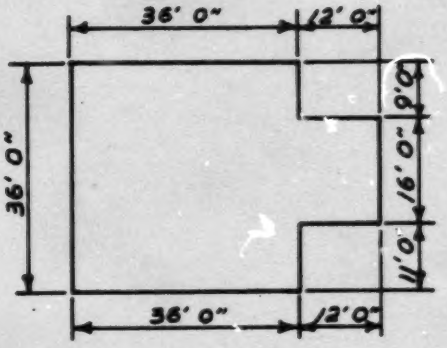
Solution:

In this figure the size and location of the openings make it necessary to cut the openings from full sheets of material.

$$\frac{\text{Lineal feet of wall}}{\text{Width of wall board}} = \frac{24 \text{ ft}}{4 \text{ ft/sheet}} = 6 \text{ sheets}$$

B. Problems without Solutions

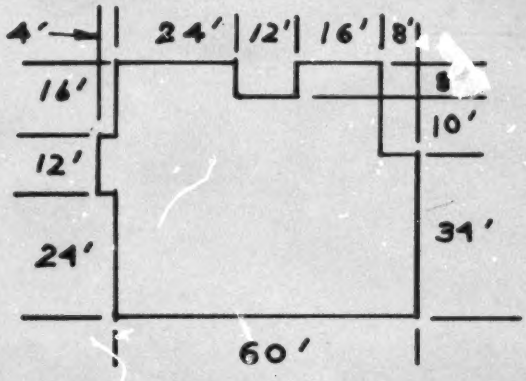
6. Find the total lineal feet of wall for the floor plan shown.



7. The walls of a building measure 242 feet, 143 feet, 210 feet, 18 feet, 32 feet, and 125 feet. What is the total length of the walls?

B. Problems without Solutions (continued)

8. The number of studs in the exterior walls can be estimated by finding the lineal feet of wall with no deductions. How many studs would be required for the exterior walls for the floor plan shown.

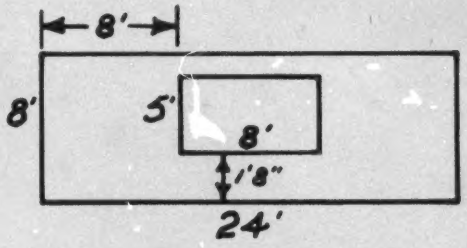


9. How many pieces of tile will be needed to cover a floor having an area of 35 square yards if there are 16 pieces of tile per square yard?

10. If one man could lay 115 square feet of flooring per hour, how many square feet could a crew of three men lay in an 8-hour day?

B. Problems without Solutions (continued)

11. Determine the number of 4' x 8' sheets of sheetrock needed to cover the wall shown:



Level 2

12. Determine the net yearly income for an apartment house if the construction cost is $165,000, gross yearly income $24,000, taxes $4813, utilities $2008, maintenance $1756, and insurance $519. Contract terms are $25,000 down, with yearly payments of $13,535. The contract is 20 years at 7¼ interest.

B. Problems without Solutions (continued)

13. Using the chart below, determine the materials needed for 3 coats of stucco on a house having 125 square yards of exterior wall. The following chart will give the approximate amounts of each ingredient needed for each coat in 100 square yards of stucco or interior plaster

PER 100 SQUARE YARDS

Type of Plaster or coat	Cement	Sand	Lime	Hair	Gypsum Plaster	Guaging Plaster
Stucco-1st coat	13 bags	26 cu ft	130 lbs	6 lbs		
Second coat	12 bags	39 cu ft	130 lbs			
Third coat	5 bags	10 cu ft	50 lbs			
Interior						
Scratch coat						
Wood lath						
Metal lath	14 cu ft				7 bags	
Button Board	1 cu ft				10 bags	
	1/2 cu ft				5 bags	
Brown coat	21 cu ft				7 bags	
Finish coat						
Sand finish	1/2 cu yd				7 bags	
Hard finish			7 bags			150 lbs

Complete Solutions to B Problems

6. Lineal ft equals perimeter length

36	feet
36	"
36	"
12	"
9	"
16	"
11	"
+ 12	"
168	feet

7. Total length of walls =

242	feet
143	"
210	"
18	"
32	"
+ 125	"
770	feet

8. Lineal ft equals perimeter length

4	feet
24	"
12	"
16	"
8	"
8	"
10	"
34	"
60	"
24	"
12	"
+ 16	"
228	feet

9. (35 ~~sq yds~~)(16 tiles/~~sq yd~~) = 560 tiles

10. If one man can lay 115 sq ft per hour, then in one 8-hour day, he could lay (115 sq ft/~~hr~~)(8 ~~hrs~~) = 920 sq ft.

If one man can lay $\frac{(920 \text{ sq ft/day})}{\text{MAN}}$ (3 ~~men~~) = 2,760 sq ft/day

Complete Solutions to B Problems (continued)

11. Since the area above and below the window can be covered by one sheet, the areas to the left and right of the window require two sheets each, a total of 5 sheets is needed.

Level 2
12.

Gross Income		$24,000
Expenses		
Taxes	$4,813	
Utilities	2,008	
Repairs and Maintenance	1,756	
Insurance	519	
Total Expenses		9,096
Net Income before debt service		$14,904
Debt service		13,535
Net Income after debt service		$ 1,369

13. 100 sq yds require:

	cement	13 bags	sand	26 cu ft
		12 "		39 "
		5 "		10 "
		30 bags		75 cu ft
	lime	130 lbs	hair	6 lbs
		130 "		
		50 "		
		310 lbs		

125 sq yds require:

cement	(1.25)(30 bags)	= 37.50 bags
sand	(1.25)(75 cu ft)	= 93.75 cu ft
lime	(1.25)(310 lbs)	= 887.50 lbs
hair	(1.25)(6 lbs)	= 7.50 lbs

A. Problems with solutions.

When property is sold, the buyer and the seller divide their expenses appropriately. This division is called prorating. To prorate you must find the unused part of taxes, fire insurance, fuel oil, etc.

One general rule to follow would be to figure the time differential first and later figure the value.

1. Jan. 1, 1973 a 3 year fire insurance policy was purchased. The property was sold March 15, 1974. What was the unused policy period?

Solution:

Year	Month	Day	
1973	1	1	
3			(3 year policy expired)
5	12	31	
~~1976~~	~~X~~	~~X~~	
1974	3	15	(selling date)
1	9	16	

to subtract these, you need to borrow. In doing this, borrow 30 days for one month and 12 months for one year.

There was 1 year 9 months 16 days of unused policy time.

2. January 1, 1973 taxes were paid for one year. The property was sold August 12, 1973. What was the unused policy period?

Year	Month	Day	
1973	1	1	
1			(taxes paid for 1 year)
3	12	31	
~~1974~~	1	1	
1973	8	12	(selling date)
0	4	19	

So there was 4 months 19 days of unused policy time.

A. Problems with solutions.

3. A home on which the taxes for the fiscal year from July 1 to June 30 were $240. The home is sold March 1. How much tax money would the seller receive from the buyer?

Solution: $(\$240/\text{year})\left(\frac{1\ \text{year}}{12\ \text{month}}\right) = \$20/\text{month}$

March 1 to June 30 is 4 months

(4 months)($20/month) = $80

B. Problems without solutions.

4. In problem #3 (above) what is the prepaid value based on a calender year? (a calender year extends from Jan 1 to Dec. 31).

5. A property owner borrowed some money July 3, 1974. The loan was to be repaid by Nov. 15, 1977. How long would the loan be in effect?

6. Glass insurance was purchased on a home April 5, 1974. The purchase was for a 5 year period. The home was sold Oct. 25, 1977. What was the unused time on the policy?

B. Problems without solutions.

7. A home in S.W. Portland is valued at $85,000. The taxes are $4020 for the fiscal year July 1 to June 30. The house is sold Feb. 1 without any taxes having been paid. What credit must be given the buyer?

8. A home being taxed on the calendar year is sold April 15. The taxes have not yet been paid.

   a) How many months credit will the buyer receive?
   b) If the tax year had been a fiscal year of July 1 to June 30, what credit would be given the buyer?

9. A loan was made on March 15th and repaid Nov. 25th. How many months and days will be charged to the borrower?

B. Problems without solutions.

10. An apartment complex has 22 units. The rent is $150 per month. One unit is vacant and all other rents have been paid. If the sale is closed on the fifth of the month, what is the value of the prepaid rents that the seller will pay the buyer?

11. A glass insurance policy was purchased June 1, 1973 for 3 years. The cost of the policy was $36. The property was sold Jan 1, 1975. What would the buyer owe the seller for the prepaid portion?

B. Problems without solutions.

12. The fiscal tax year is July 1 to June 30. If the house is sold Sept. 1:

    a) How many months are charged to the buyer?
    b) If the tax year had been a calendar year, how many months credit would be given the buyer if the taxes had not been paid?

13. For a fiscal tax year of Nov. 1 to Oct. 31, the taxes of $510 have been paid. The property is sold May 1. What amount of tax money belongs to the sellers?

Complete solutions to 8 problems.

4. March 1 thru Dec. 31 is 10 months
(10 ~~months~~) ($20/~~month~~) = $200

5.

Year	Month	Day
1977	11	15
1974	7	3
3	4	12

The loan would be in effect 3 years, 4 months, 12 days

6.

Year	Month	Day	
1974	4	5	
5			(5 year policy)
8	16	35	
~~1979~~	~~4~~	~~5~~	
1977	10	25	(selling date)
1	6	10	

The unused policy period was 1 year, 3 months, 10 days.

7. July 1 to Feb 1 is 7 months

($4020/~~year~~) $\left(\frac{1\ \text{~~year~~}}{12\ \text{months}}\right)$ = $335/month

(7 ~~months~~) ($335/~~month~~) = $2345

8. a. Jan. 1 to April 15 is 3 1/2 months
b. July 1 to April 15 is 9 1/2 months

9.

Months	Days	
11	25	
- 3	15	
8	10	8 months 10 days

10. Total rent recieved = ($150/~~unit~~) (21 ~~units~~)

= $3150/month

Converting ($3150/ month) (1 ~~month~~/30days) = $105.00/day

(25 ~~days~~) ($105/ ~~day~~) = $2625

Complete solutions to B problems, continued.

11.

	years	months	day	
	1973	6	1	
+	3			(3 year policy)
	1976	6	1	
-	1975	1	1	(selling date)
	1	5	0	(credit to the seller)

$ 36/3 years = #12/year

$(\$12/\text{year})\left(\frac{1\ \text{year}}{12\ \text{months}}\right) = \$1/\text{month}$

Total credit to seller:=(\$12/year)(1 year) +(\$1/month)(5 months)

= \$12 +\$5

= \$17

12. a) July 1 to Sept. 1 is 2 months

b) Jan 1 to Sept. 1 is 8 months

13. $(\$510/\text{year})\left(\frac{1\ \text{year}}{12\ \text{months}}\right) = \$42.50/\text{month}$

Nov. 1 to May 1 is 6 months

(6 months)(\$42.50/month) = \$255.00

A. Problems with solutions.

1. A tract of ground 30 rods by 16 rods contains how many acres? (Note: 1 acre = 160 sq rds)

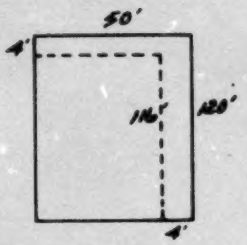
   Solution:

   (30 rods)(16 rods) = 480 sq rds

   (480 ~~sq rds~~) (1 acre/160 ~~sq rds~~) = 3 acres

2. How many square feet of concrete surface would be needed to construct a walk of 4 feet wide around the <u>outside</u> corner lot that measures 50 feet by 120 feet? (Hint: Draw a picture)

   Solution:



   (54 feet)(4 ft) = 216 sq ft.

   (170 ft) (4 ft) = <u>680 sq ft.</u>
   896 sq ft.

3. What is the cost of a lot 264 feet by 660 ft at a price of $800 per acre?

   Solution:

   (264')(660') = 174,240 sq ft

   $(174{,}280\ \text{~~sq ft~~}) \left(\frac{1\ \text{acre}}{43560\ \text{~~sq ft~~}}\right) = 4$ acres

   ($800/~~acres~~) (4 ~~acres~~) = $3200

4. A contractor built a house 40 feet wide and 70 feet long. It had an average height, on the inside, of 8 feet. How many cubic feet were inside the house?

   Solution:

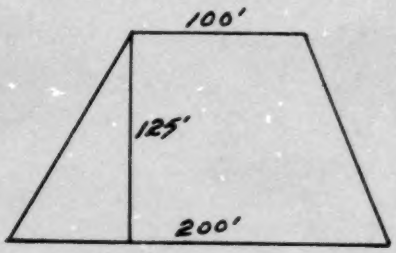
   Volume = (length)(width)(height)

   = (70')(40')(8')

   = 22400 cu ft

B. Problems without solutions.

5. The following lot is in the shape of a trapezoid. What is the area? (Note: To find the area of a trapezoid, add the parallel sides, and divide by 2. Then multiply the result by the distance between those sides).



6. 3 acres of land has how many square rods in it?

7. A lot 65 ft. wide and 150 ft. deep sold for $7670. What was the price per front foot?

8. How many square yards in 30,000 square feet?

B. Problems without solutions.

9. A parcel of land contained 348,380 square feet. It was sold for $700 per acre. For how much did the owner sell his land?

10. What would be the purchase price of a lot 45' x 100' at $25 per square foot?

11. How many cubic feet in 53 cubic yards?

12. What is the depth of a rectangular lot containing 8554 sq. ft, with a width of 47 ft.?

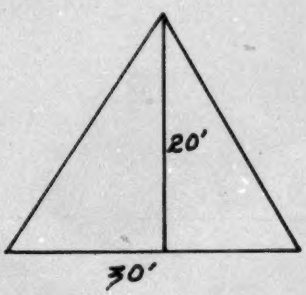
13. How many acres are in a parcel of land measuring 132' x 330'?

B. Problems without solutions.

14. A house measures 24' x22' with an average height of 10'. The window and door openings total 220 sq. ft. How many construction squares of siding will it take to cover the house? (Note: A consstruction square is 100 sq. ft.)

15. How many square feet of concrete surface would be needed to construct a walk 4 feet wide on the <u>inside</u> corner of a lot that measures 50 feet by 120 feet. (Hint: Draw a picture.)

16. The following lot is in the shape of a triangle. What is its area? (Hint: Multiply the base by the height and divide by 2).

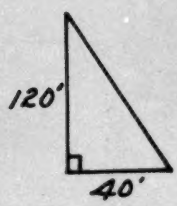


B. Problems without solutions.

17. A contractor promised to build a house 30 feet x 70 feet for $12 a square foot. What will be the cost of the house?

18. How many acres of land is 261,360 square feet?

19. What is the area of the following parcel of land?



B. Problems without solutions.

20. How many cubic feet are inside a house that measures 35 feet wide, 45 feet long and averages 8' in height?

21. A lot 90 feet wide and 127 feet deep sold for $5400. What was the price per front foot?

Complete solutions to B problems.

5. Area = 1/2 h (base + base)

= 1/2 (125')(100' +200')

= 1/2 (125')(300')

= 18750.00 sq. ft.

6. $\left(\frac{160 \text{ sq rds}}{\text{acre}}\right)$ (3 ~~acres~~) = 480 sq. rds.

7. $7670/65 front foot = $118/front ft.

8. (30,600 ~~sq ft~~) (1 sq yd/ 9 ~~sq ft~~) = 3400 sq yds

9. (348,480 ~~sq ft~~) $\left(\frac{1 \text{ acre}}{43{,}560 \text{ sq ft}}\right)$ = 8 acres

(8 ~~acres~~) ($700/~~acre~~) = $5600

10. Area = (45') (100')

= 4500 sq ft.

(4500 ~~sq ft~~) ($25/~~sq ft~~) = $112,500.00

11. (53 ~~cu yds~~) $\left(\frac{27 \text{ cu ft}}{1 \text{ cu yd}}\right)$ = 1431 cu ft

12. Area = (length) (width)

8554 sq ft = (length) (47 ft)

8554 ~~sq~~ ft/47~~ft~~ = length

182 ft = length

13. Area = (132 ft)(330 ft) = 43560 sq ft

(43560 ~~sq ft~~) $\left(\frac{1 \text{ acre}}{43560 \text{ sq ft}}\right)$ = 1 acre

Complete solutions to B problems.

14. The problem is to find the surface area of the house.

Two sides of the house have a surface area of

$(24')(10') = 240$ sq ft

The other two sides have a surface area of

$(22')(10') = 220$ sq ft

Total surface area $= 2(240 \text{ sq ft}) + 2(220 \text{ sq ft})$

$= 480 \text{ sq ft} + 440 \text{ sq ft}$

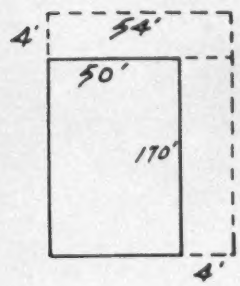
$= 920$ sq ft

Area to be covered $= 920 \text{ sq ft} - 220 \text{ sq ft}$

$= 700$ sq ft

The siding necessary $= 700$ sq ft $\quad 100$ sq ft/square $= 7$ construction squares.

15.



50' x 4' = 200 sq ft
116' x 4' = 464 sq ft
total 664 sq ft.

16. Area = (base)(height)/2

$= (30')(20')/2$

$= 600 \text{ sq ft}/2$

$= 300$ sq ft

17. Area of the house $= (30')(70')$

$= 2100$ sq ft

Cost of the house $= (2100 \text{ ~~sq ft~~})(\$12/\text{~~sq ft~~})$

$= \$25{,}200$

Complete solutions to B problems, continued.

18. $(261{,}360 \text{ ~~sq ft~~}) \left(\frac{1 \text{ acre}}{43{,}560 \text{ ~~sq ft~~}}\right) = 6 \text{ acres}$

19. Area = (base)(height)/2

= (40') (120') /2

= 4800 sq ft/2

= 2400 sq ft

20. Volume = (length)(width)(height)

=(45')(35')(8')

= 12600 cu ft

21. $5400/90 ft = $60/front foot

A. Problem with Solution

1. The data below represents an actual truckload of cherries:

Load #1
P.I.E.
Tank Truck # 141105
Trailer # 142105

Truck Gross wt.	39,100
Truck Tare	19,280
	19,820
Brine 990 gal	8,320
Cherries 1342 gal	11,500
Trailer Gross wt.	36,290
Trailer Tare	8,880
	27,480
Brine 1285 gal	10,800
Cherries 1948 gal	16,680

(a) What is the total number of pounds of cherries delivered?

(b) What is the total gallons of cherries?

(c) What was the average weight of a gallon of cherries? (to the nearest thousandth)

Solution:

(a) Pounds of cherries delivered = 11,500 lbs + 16,680 lbs
= 28,180 lbs

(b) Gallons of cherries = 1,342 gal + 1,948 gal = 3,290 gal

(c) Average weight = $\frac{28,180 \text{ lbs}}{3,290 \text{ gal}}$ = 8.565 lbs/gal

B. Problem without Solution

2. Below are actual test data from seven cherry brining tanks in Salem.

Tank	SO^2	PH	Pressure	High Reading	Low Reading
#1	0.6	3.55	745.5	850	650
#2	0.75	3.7	764	890	650
#3	0.75	3.65	694-1/2	840	610
#4	0.8	3.85	585-1/2	720	400
#5	1.1	3.3	711-1/2	850	620
#6	0.7	3.5	687-1/2	790	590
#7	0.8	4.0	596	720	510

State the average SO_2, Ph, pressure, high reading and low reading for your condition report.

Complete Solution to B Problem

2. Average $SO_2 = \frac{0.6 + 0.75 + 0.75 + 0.8 + 1.1 + 0.7 + 0.8}{7}$

$= \frac{5.5}{7} = 0.786$

Average Ph $= \frac{3.55 + 3.7 + 3.65 + 3.85 + 3.3 + 3.5 + 4.0}{7}$

$= \frac{25.55}{7} = 3.65$

Average Pressure $= \frac{745.5 + 764 + 694.5 + 585.5 + 711.5 + 687.5 + 596}{7} =$

$\frac{4,784.5}{7} = 683.5$

Average high reading $= \frac{850 + 890 + 840 + 720 + 850 + 790 + 720}{7}$

$= \frac{5,660}{7} = 808.6$

Average low reading $= \frac{650 + 650 + 610 + 400 + 620 + 590 + 510}{7}$

$= \frac{4,030}{7} = 575.7$